

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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RADIOLOGY

A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES
PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA, INC.

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Upper Gastrointestinal Tract Alterations in Adenomatosis of the Endocrine Glands¹

RALPH SCHLAEGER, M.D., MARJORIE LE MAY, M.D., and PAUL WERMER, M.D.

VARIOUS facets of a syndrome which, on one hand, concerns tumors of the endocrine glands and, on the other, a group of nonendocrine lesions occurring in the upper gastrointestinal tract have been recognized with increased frequency. The complete syndrome is not nearly as well known as the fragmentary associations within it, and the radiologic features of the gastrointestinal alterations have not previously been subjected to critical evaluation. Of the disparate manifestations, the gastrointestinal are of utmost importance from the standpoint of management and the ultimate prognosis. It is primarily because of the peptic ulcerations, their multiplicity, their tendency to perforate and bleed, and their predictable recurrence following surgical intervention, that any form of therapy has been fraught with insurmountable difficulty. Similarly, the marked gastric hypersecretion is equally refractory to all forms of therapy short of total gastrectomy. This important aspect of the syndrome has accounted for clinical problems ranging from profound electrolyte disturbances to a sprue-like picture with profuse watery diarrhea. In addition to the ulcerations of the upper gastrointestinal tract, including the jejunum, and the pronounced gastric hypersecretion, villous adenomas have been present in the colon.

Within the framework of the endocrine phase of this syndrome, glandular involvement is characterized by tumors principally of the anterior pituitary, the parathyroids, and the islets of Langerhans; the adrenals and thyroid are less frequent sites of adenoma formation. Lipomas in various sites, extrinsic to the endocrine system and the gastrointestinal tract, have represented rather frequent but hardly coincidental findings in this group of patients. Nevertheless, the basic components are tumors of multiple endocrine glands and peptic ulcerations which follow an unrelenting course in spite of any form of treatment.

The current concepts of this clinical entity are predicated on the early descriptions of the simultaneous occurrence in the same persons of adenomas of the anterior pituitary, the parathyroids, and the islet cells of the pancreas. Observations by Erdheim (9) in 1903, Claude and Bau-douin (35) in 1911, and Lloyd (19) in 1929, concerned the underlying histopathological findings. In the next several decades attention was directed to the endocrine disturbances and their clinical features; important contributions were made in this era by Kalbfleisch (18) in 1937, Gerstel (14) in 1938, and Shelburne and McLaughlin (30) in 1945. Gerstel's report contained

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a description of gastric polyposis in a case of pluriglandular adenomatosis.

The association of intractable peptic ulceration with endocrine tumors had been recorded for a number of years. However, in 1953, Underdahl, Woolner and Black (32) first reported on a group of patients with adenomatosis of the pancreatic islet cells, anterior pituitary, and parathyroids, in whom coexisting ulcerative disease of the upper gastrointestinal tract was observed. The initial documentation of the familial occurrence of this syndrome by Wermer (35), in 1954, presented the pedigree of a family in which four sisters suffering from adenomatosis of the endocrine glands also showed refractory peptic ulcers. It was in this report that the genetic basis for the coexistence of the endocrine and gastrointestinal lesions was proffered. In the same year, Moldawer, Nardi and Raker (25) described two additional cases of this association.

Zollinger and Ellison (38), in 1955, observed severe, unrelenting ulcers in the presence of pancreatic islet-cell tumors although there was no apparent involvement of other endocrine glands in the majority of their cases. While all of the patients were not studied from the standpoint of pluriglandular disease, it is very probable that these cases represented an incomplete form of this syndrome, a *forme fruste*. This seems to pertain as well in the cases of isolated hyperparathyroidism due to involvement of several parathyroid glands as described by Jackson (17), by Cope *et al.* (4), and by Hellström (15). Since adenomas of such different types coexist with peptic ulcers, it has been maintained by Wermer that these tumors represent nothing more than the endocrine expression of an abnormal gene which in the gastrointestinal tract results in ulceration. Others have attempted to establish a causal relationship between the endocrine tumors and the gastrointestinal lesions. Nevertheless, it is important to recognize that the sequence of organ involvement symptomatically varies so that in one patient the gastrointestinal precede the

endocrine manifestations while in others the endocrine aberrations are seen first.

The endocrine glands participating in frank adenoma formation or hyperplasia include one or more of the following, as previously mentioned: the pancreatic islets, the parathyroids, the anterior pituitary, and the adrenal cortex. In some cases, the thyroid is enlarged and is the site of adenomatous hyperplasia. The pancreatic adenomas usually are multiple, ranging from a few millimeters to several centimeters in diameter. It is significant that these adenomas often are found in the wall of the stomach or duodenum. In the pancreas they may coexist in sporadic cases with lesions representing islet-cell carcinoma. Characteristically, the histopathologic feature is the so-called "ribbon pattern." The tumors generally are non-functioning, although occasionally a functioning adenoma exists, accounting for the classical picture of hyperinsulinism. The pathological changes in the parathyroid glands in patients with multiple endocrine adenomas have been clearly defined by Cope *et al.* The adenomatous hyperplasia is primarily of the chief-cell type, although other cellular elements may participate in this process. Multiple parathyroid gland involvement is the rule, and frequently all four glands are enlarged. On the other hand, there is no constancy in the cell type of the anterior pituitary tumors. The acidophilic lesions produce acromegaly, while chromophobe adenomas cause hypopituitarism and occasionally dwarfism. Several or all of these glands may be involved in a given patient.

Among the other tumors occurring in this syndrome, the most frequent are lipomas arising extrinsic to the endocrine system and the gastrointestinal tract. Subcutaneous lipomas are often multiple, while retroperitoneal location of such tumors has also been observed. In addition, lipomas of the respiratory passages have been found. Infrequently, there are villous adenomas of the colon which cannot be distinguished from lesions in patients not afflicted with the syndrome.

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Clinical differentiation of ulcerative disease belonging to this category from the more commonly observed isolated peptic ulcer presents numerous obstacles. Such distinction, however, is of utmost importance from both therapeutic and prognostic standpoints. Zollinger and Ellison have defined clearly the intractable nature of these ulcers and have commented on the lack of response to medical or the most radical forms of surgical therapy. In those patients in whom the endocrine manifestations are obvious, identification is hardly a problem, but in the absence of the clinical hallmarks of pancreatic islet-cell, parathyroid, and pituitary tumors, the diagnosis of ulcer predicated on such a background is difficult to establish. Accordingly, our attention has been focused on the roentgenologic findings as an aid in the separation of this group of patients from the broad category of peptic ulcer.

An analysis of our cases and those in the literature has disclosed a rather unique and oftentimes characteristic constellation of roentgenologic findings in the gastrointestinal tract. The stomach is the site of a large fluid residuum, which is a function of hypersecretion and not a result of obstruction to gastric outflow. Significantly, gastric emptying of barium is not impeded but, on the contrary, is often in the rapid range. Intermittent aspiration of gastric secretions is often necessary during the course of contrast studies. Menetrier's disease, which consists of generalized giant fold formation in the stomach, is present frequently to such a degree that polypoid defects in the barium column are produced. The large rugae are not effaced with distention of the viscus; nevertheless, there is no apparent rigidity of the gastric wall. Although Gerstel observed gastric polyposis in a case of polyglandular adenomatosis, increased incidence of adenomatous polyps in the stomach has not been recorded. The gastric ulcers generally are seen in association with rugal enlargement. The gastric and duodenal ulcers are in themselves indistinguishable roentgenologically from

the usual peptic ulcer of the upper gastrointestinal tract. Significant features, when present, are their enormous size and multiplicity and a tendency to be located at unusual sites.

The roentgenologic changes in the duodenal loop frequently are associated with ulcerative disease in the second and third portions of the duodenum. There is no widening of the duodenal loop *per se* unless a gross mass exists in the head of the pancreas; this usually does not occur with islet-cell tumors. The caliber of the duodenal lumen, however, is widened distal to the duodenal bulb, the mucosal folds are markedly enlarged and coarsened, and the walls are rigid. Marginal irregularities correspond to the interstices between the thickened folds or to actual ulcer craters. The intramural adenomas may produce defects in the barium column which are difficult to distinguish from the massively enlarged folds. The overall appearance is that of a megaduodenum which is the site of diminished peristalsis and retention of contrast material. The latter is sufficiently marked to suggest partial organic obstruction in the distal duodenum or proximal jejunum. A rather rare occurrence has been intramural sinus formation along the outer arc of the duodenal loop. The extraluminal collections appeared to be submucosal in location and the sinuses paralleled the wall of the second and third portions of the duodenum.

In the jejunum, coarsening of the folds, rigidity of the walls, and multiple ulcerations also have been present. For the most part, these changes have been in the region of the ligament of Treitz or in the segment of jejunum located somewhat distally. The ulcers frequently perforate to produce evidences of localized peritonitis. In previously reported cases, these changes in the jejunum have suggested the pattern observed in regional enteritis; further, the inflammatory mass about the proximal jejunal loops in which ulcer perforation has occurred may be mistaken for separation of small intestinal loops due to thickening of the mesentery in non-

specific enteritis. However, in the absence of mucosal changes other than coarsening and actual attenuation of the caliber of the lumen, such a diagnosis becomes less probable.

The prominence of the small-intestinal folds has been observed in the absence of ulceration distal to the ligament of Treitz. Clinically, patients with this form of intestinal involvement in endocrine adenomatosis frequently display a picture characterized by profuse watery diarrhea. The thickened folds are consistently demonstrated on small intestinal studies with nonflocculating barium and, in the presence of an increased volume of fluid incident to gastric hypersecretion, dilution of the barium suspension is observed. The striking finding is the adherence of the contrast material to the large folds after the major bolus has passed distally. The distribution is in the form of delicate lines corresponding to the margins of the folds rather than small flakes or clumps characteristic of the phenomenon of flocculation in sprue.

In the post-gastrectomy state, recurrence of ulcerations is rapid, often in spite of vagotomy. The ulcerations are large and frequently multiple and are associated with marked fold enlargement in the jejunal loop when gastrojejunostomy has been employed. The jejunal lumen is widened, the walls are rigid, and marginal irregularities are similar to those observed preoperatively in the duodenal loop. In some patients, the presence of multiple jejunal ulcers following gastrojejunostomy has been associated with effacement of the fold subsequent to demonstrable thickening. Remedial surgery, including vagotomy, has been followed by ulcer recurrence and such complications as perforation and hemorrhage. Even after total gastrectomy, ulcers have occurred proximal to the esophagojejunostomy site, and perforation of a distal esophageal ulcer into the pleural space has been a terminal event.

Several cases have been selected to illustrate the roentgenologic findings in the upper gastrointestinal tract in patients

with endocrine adenomatosis. They have had either the complete syndrome or partial endocrine manifestations coexisting with gastrointestinal alterations.

REPORT OF CASES

CASE I (Fig. 1): H. W., a 43-year-old white male, was first seen at the Presbyterian Hospital because of perforation of an isolated jejunal ulcer which was treated by simple closure. One year later a subtotal gastrectomy with antecolic gastrojejunostomy was performed for pyloric obstruction secondary to duodenal ulcer. This was followed in the immediate postoperative period by stump disruption. A thoracic vagotomy was done in 1954, in the management of a bleeding marginal ulcer, and one year later recurrence of the jejunal ulcer followed in the wake of marked elevation in gastric acidity. At that time the serum calcium was elevated, the serum phosphorus was diminished, and a left ureteral calculus was demonstrated roentgenographically. Suppression of gastric hyperacidity was attempted, by the use of external radiation therapy, h.v.l. 3.7 mm. Cu, with a tissue dose of 2,000 r delivered to the stomach in two weeks through opposing anterior and posterior left upper abdominal portals.

In 1959, attention was directed to a recurrent marginal ulceration by massive hematemesis requiring 15 pints of blood for replacement and stabilization. Definitive therapy consisted of total gastrectomy, esophagojejunostomy, jejunoo-jejunostomy, and splenectomy. An islet-cell tumor was found in the fundus of the stomach, and pyloric metaplasia of the jejunal mucosa was present in association with the marginal ulcer. Histopathologic sections of the jejunal mucosa revealed edema, hemorrhage, and multiple ulcerations. Because of the elevated serum calcium, decreased serum phosphorus and a lytic lesion in the proximal right humerus compatible with osteitis fibrosa cystica, exploration of the neck was carried out. Adenomatous hyperplasia of three parathyroid glands, consisting predominantly of chief and oxyphilic cell types, was found.

Comment: The polyglandular adenomatosis and ulcerative disease of the upper gastrointestinal tract in this case required multiple surgical procedures over a period of seven years. The unrelenting course of the ulcerative disease has responded thus far to total gastrectomy. The islet-cell tumor was discovered in the gastric wall, and the hyperparathyroidism was associated with hyperplasia of multiple parathyroid glands. The lack of response of the gastric hypersecretion and hyperacidity

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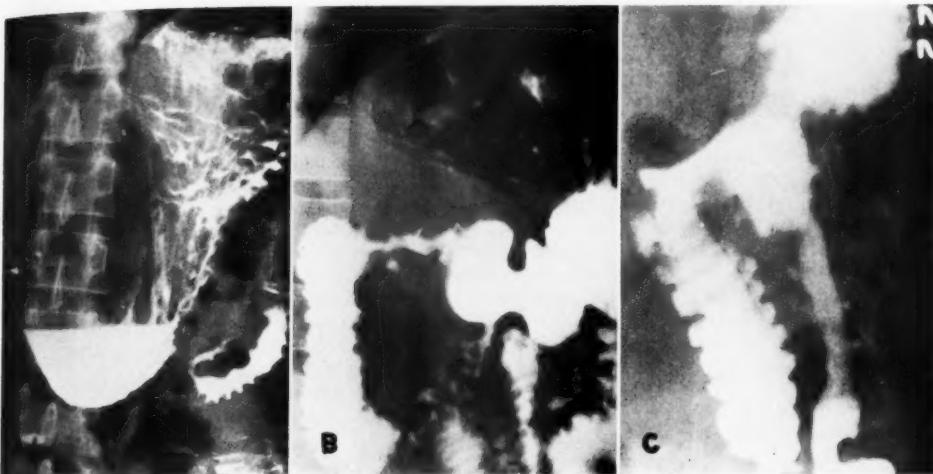


Fig. 1. Case I. A. Marked gastric hypersecretion, rigidity of small intestinal loops as delineated by air, and fold enlargement of jejunum as demonstrated with barium.

B. Severe duodenal deformity, increased width of the second and third portions of the duodenum, and prominent folds in the distal duodenum and jejunum.

C. Postoperative status, with prominence of the folds of the afferent limb, effacement of folds of the efferent limb, marginal alterations secondary to fold enlargement, and multiple ulcerations.

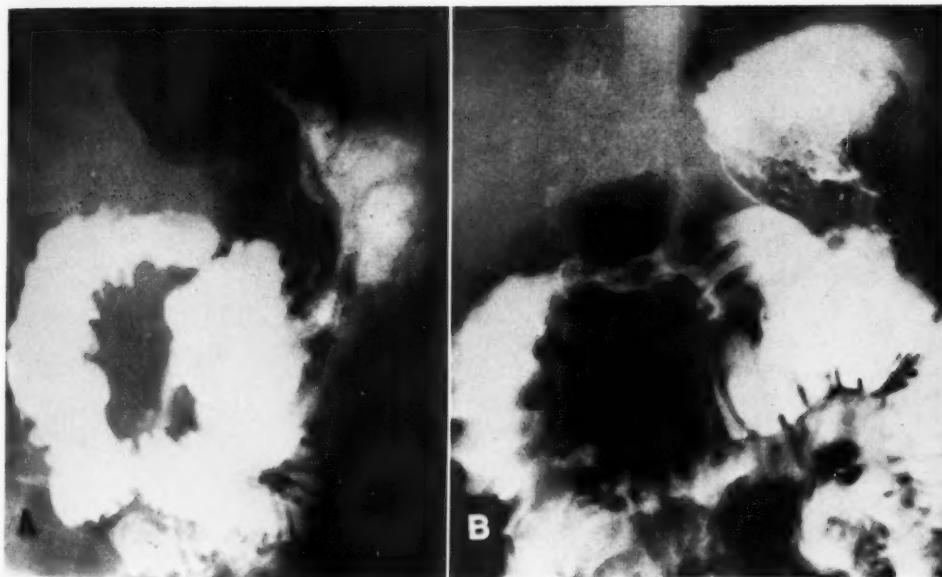


Fig. 2. Case II. A. Duodenal mucosal fold enlargement associated with widening of the lumen of the second portion of the duodenum.

B. Further demonstration of megaduodenum, marked fold enlargement, and a periamppullary collection representing a duodenal ulcer. The last is also demonstrated along the medial arc of the second portion of the duodenum in the first film. The folds of the jejunum are enlarged.

to radiation therapy, even in the presence of adequate vagectomy, is frequently observed in this syndrome.

CASE II (Fig. 2): C. P., a 51-year-old teacher, was first seen at the age of twenty because of headaches, vomiting, and somnolence. A diagnosis of chromophobe adenoma of the pituitary was made in

the presence of gross sellar enlargement, and a course of external radiation therapy was instituted. The patient had never menstruated. A mucoepidermoid endotracheal tumor was removed at the age of thirty-eight. Shortly thereafter episodes of disorientation occurred, associated with hypoglycemia, which responded to glucose administration. Recurrent epigastric pain was present for approximately ten years, and duodenal ulcerative disease was documented on several occasions. For the past two years, the striking finding had been profuse watery diarrhea with repeated bouts of vomiting and crampy abdominal pain. Radiologic studies of the upper gastrointestinal tract and small intestine showed coarsening of the duodenal folds, and alterations in the jejunum initially were considered to represent either sprue or nonspecific enteritis.

At the time of the last admission in 1959, recurrent abdominal pain prompted interval roentgenologic investigation of the upper gastrointestinal tract and small intestine. The pertinent findings included gastric hypersecretion, gross enlargement of the folds of the stomach, duodenum, and jejunum, and an ulcer crater in the second portion of the duodenum. The barium mixed with the secretions in the small intestine and remained between the enlarged folds of the jejunum after the bolus had passed distally. A 50 per cent gastrectomy, subdiaphragmatic vagotomy, splenectomy, excision of the tail of the pancreas and two nodules in the jejunal mesentery, and a Billroth II gastrojejunostomy were performed. The mass in the pancreas contained both islet-cell adenoma and islet-cell carcinoma.

Another facet of the syndrome was hypercalcemia, associated with generalized demineralization. It is of interest that three sisters of the patient have the syndrome of endocrine adenomatosis and that the father died of a perforated ulcer which, at autopsy, was found to be associated with an islet-cell tumor of the pancreas. There are many other members of the family with endocrine adenomatosis and ulcer.

Comment: This patient had, in addition to pluriglandular involvement and a familial history of endocrine adenomatosis, gastrointestinal changes which initially were confused with nonspecific enteritis or sprue. She had, also, profuse watery diarrhea as well as peptic ulcer. Following gastric surgery the diarrhea disappeared. Islet-cell adenoma and carcinoma coexisted in the pancreas, a finding which is not unusual.

CASE III (Fig. 3): O. P., a 44-year-old sister of C. P., was first seen in September 1954 because of exacerbations of epigastric pain over a period of three months. A diagnosis of duodenal ulcer had been made five years earlier and in the interim the patient

was treated medically. Radiologic examination demonstrated the presence of two duodenal ulcers and enlargement of the folds of the duodenum. Physical examination revealed soft subcutaneous lipomas on the back. Several admissions for epigastric pain were followed, in 1957, by hematemesis requiring 9 pints of blood for stabilization. A Hofmeister resection and posterior gastrojejunostomy were done. An adenoma, 1.0 cm. in diameter, was resected from the tail of the pancreas. The duodenal ulcer, at the time of surgery, was approximately 2.0 cm. in diameter. Multiple islet-cell adenomas were demonstrated on the histopathological preparations, there was hyperplasia of Brunner's glands in the duodenum, and ectopic fundic glands were noted in the pyloric canal.

Approximately four weeks after surgery recurrent epigastric pain prompted reinvestigation of the upper gastrointestinal tract. Contrast studies disclosed a marginal ulcer in the efferent limb of the jejunal loop. This was treated by transthoracic vagotomy. Although symptoms which have been classified as "dumping" developed postoperatively, there have been no evidences of ulcer recurrence. Other important features in the clinical picture included an endosellar tumor, beginning acromegaly, and secondary amenorrhea. The patient had one episode of acute abdominal pain which was attributed to nephrolithiasis.

Comment: Both pituitary and islet-cell adenomas were present in this patient with peptic ulcerative disease and a familial history of endocrine adenomatosis. Gastric resection for multiple ulcers was followed promptly by the development of marginal ulceration which necessitated vagotomy. This patient also had multiple subcutaneous lipomas, a nonendocrine feature of the syndrome.

CASE IV (Fig. 4): F. S., a 34-year-old sister of C. P. and O. P., was well until the age of twenty-one, when sudden irregularity in menses was followed by cessation. Weight gain was progressive, there was enlargement of the hands, feet, and lower jaw, headaches became increasingly severe, and libido disappeared. Approximately one year later, a diagnosis of pituitary tumor with acromegaly was made and external radiation therapy was instituted. One year prior to this event, episodes of hypoglycemia were first observed, recurring intermittently, with blood sugar levels at 30 mg. per cent. It is of interest that a third sister with secondary amenorrhea underwent pancreatectomy for hyperinsulinism and that islet-cell adenomas were verified.

In May 1951, partial pancreatectomy was performed and multiple islet-cell tumors were found; the post-pancreatectomy diabetes was controlled

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Fig. 3. Case III. A. Multiple duodenal ulcers and fold pattern of the second portion of the duodenum, which is normal. B. One year later, deformity of the duodenal bulb and change in the mucosal pattern of the duodenal loop as well as in its caliber. C and D. Four weeks after Billroth II resection with gastrojejunal ulcerations and marked prominence of the mucosal folds of the jejunal loop.

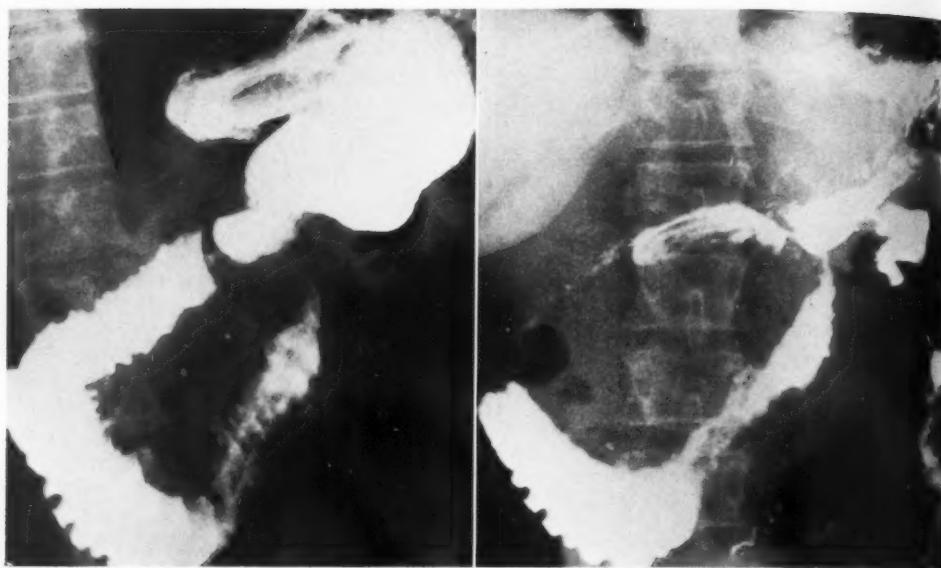


Fig. 4. Case IV. Duodenal loop widening due to a pseudocyst of the pancreas following partial pancreatectomy for hyperinsulinism. The caliber of the duodenum is increased and the folds of the third portion of the duodenum are especially prominent. Little contrast material has passed beyond this segment.

without difficulty by insulin. At that time serum calcium was 12 mg. per cent and serum phosphorus 2.7 mg. per cent. Four months later the patient was readmitted for abdominal pain and the presence of an epigastric mass. A pseudocysts of the pancreas and duodenal ulcer were demonstrated by contrast studies and treated conservatively.

One month later, readmission was occasioned by an acute exacerbation of epigastric pain, hematemesis, and melaena. Partial gastrectomy, Billroth II gastrojejunostomy, and partial excision of a pancreatic pseudocyst were performed. Islet-cell adenomas were found in the wall of the duodenum.

The fourth and final admission, one month and seven months following partial pancreatectomy for hyperinsulinism, necessitated anticoagulation therapy for pulmonary infarcts. Hematemesis and melena developed with obstruction at the gastrojejunostomy stoma. At operation, a perforated gastric ulcer located high on the anterior wall near the lesser curvature was found. The ulcer was adherent to the liver and there was generalized plastic peritonitis. The perforation was closed by plication. Postoperatively, the patient pursued a downhill course and died four weeks later.

Comment: Although this patient had clinical evidences of multiple endocrine involvement, the downhill course was occasioned by complications arising from the gastrointestinal manifestations. At autopsy islet-cell adenomas were found in

the pancreas. In addition, there were adenomas of the adrenal, hyperplasia of the parathyroid glands, a mixed adenoma of the pituitary, thyroid adenomas, and metastatic calcification in the tubular epithelium of the kidneys. There was a perforated gastric ulcer and an acute duodenal ulcer. The mucosa of the duodenum was markedly hyperemic and edematous, and small slightly elevated nodules were observed.

CASE V (Fig. 5): R. D., a 35-year-old male, was admitted to the Boston Veterans Administration Hospital with a two-year history of profuse watery diarrhea which was refractory to medical management. This had become progressively severe and was associated with intermittent epigastric distress, lower abdominal cramps, and vomiting. Eleven years earlier a renal calculus had been passed spontaneously. Pertinent physical findings on admission were evidences of recent weight loss, minimal lower abdominal tenderness, and clubbing of the fingers and toes. Examination of the upper gastrointestinal tract showed marked gastric hypersecretion and prominence of the gastric, duodenal, and jejunal folds. Gastroscopy revealed changes classified as hypertrophic gastritis; no abnormalities were apparent on proctoscopy and barium studies of the colon.

During the next eight months, the diarrhea remained unresponsive to treatment. Interval re-

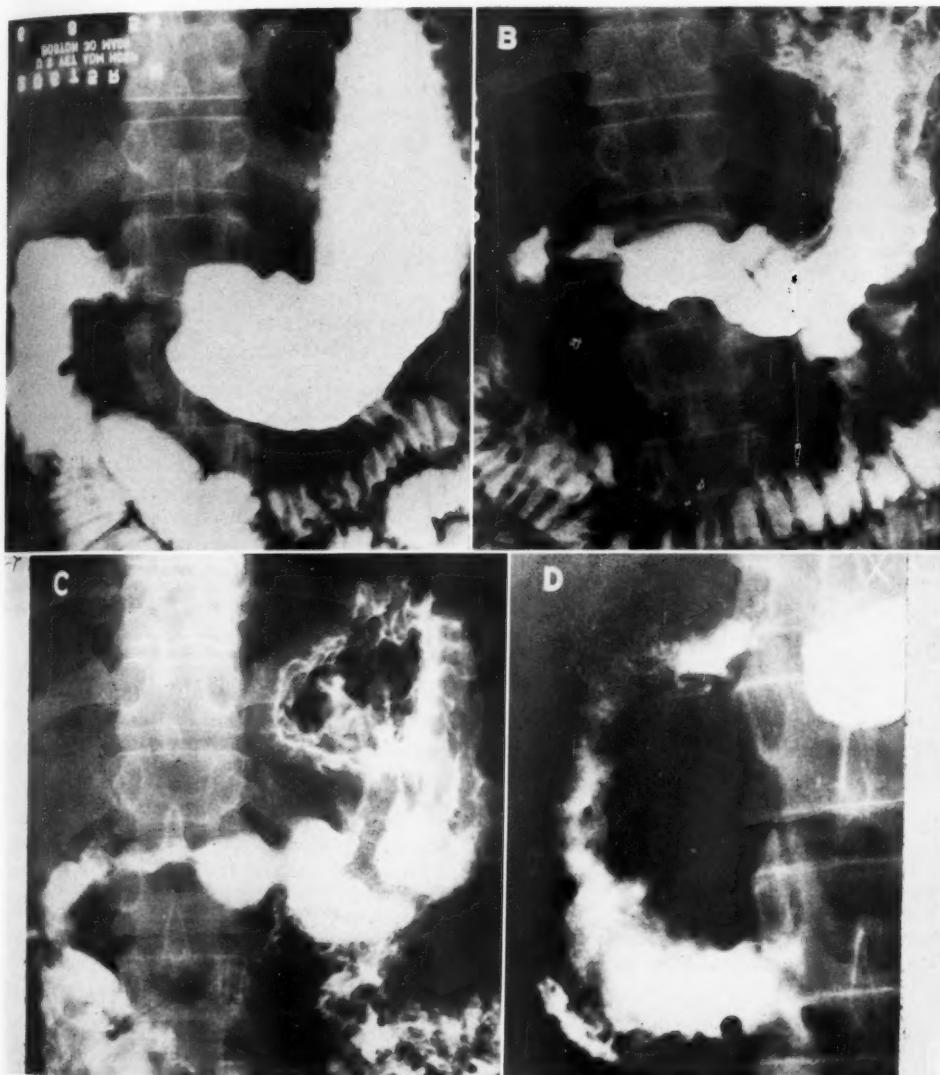


Fig. 5. Case V. A and B. Marked gastric fold enlargement, megaduodenum and enlargement of the folds in the second portion. The duodenal bulb is deformed. A collection is present in the periampullary region along the medial arc of the loop which is consistent with an ulcer crater. The folds in the jejunum resemble colonic haustrations. C. Further progression in the duodenal loop changes and development of submucosal sinuses as seen in "spot film" D.

examination of the upper gastrointestinal tract demonstrated marginal irregularities of the second and third portions of the duodenum, submucosal sinuses paralleling the duodenum, and a megaduodenum with fold enlargement and distortion. External radiation therapy, consisting of a tissue dose of 1,500 r, was directed at the stomach in an effort to control the gastric hyperacidity and hypersecretion. No subjective or objective improvement followed irradiation.

Two years after the initial admission, an acute exacerbation of symptoms occurred and, in the presence of free peritoneal air, a diagnosis of a perforated hollow viscus was made. At operation, a perforated high jejunal ulcer was treated by resection of the involved jejunal segment. The specimen contained four ulcers measuring 0.5 to 2 cm. in diameter; there were moderate hyperemia and mucosal hypertrophy. The postoperative course was progressively downhill and the patient died on the eighth day.

Postmortem examination disclosed multiple gastric ulcers in the cardia, fundus, and pylorus, the largest being situated at the esophagogastric junction. Other ulcers were present in the distal duodenum and proximal ileum. Hypertrophic gastritis and follicular hyperplasia and hyperemia of the duodenum and jejunal mucosa were observed. Islet-cell carcinomas were found in the head and tail of the pancreas as well as in the peripancreatic lymph nodes. A small tumor of the same histopathology was located in the wall of the second portion of the duodenum. The pituitary contained a minute chromophobe adenoma, and there was adrenal cortical hyperplasia; the parathyroids were not studied. Microscopic examination of the kidneys revealed nephrocalcinosis.

Comment: This patient's course extended over a period of four years and terminated fatally following jejunal resection for a perforated ulcer. A striking symptom was the profound watery diarrhea secondary to the marked gastric hypersecretion. Gastric hypersecretion and hyperacidity did not respond to radiation therapy. Multiple islet-cell carcinomas, a chromophobe adenoma, and adrenal cortical hyperplasia were present as well as multiple ulcerations extending from the esophagogastric junction to the ileum.

CASE VI (Fig. 6): A 45-year-old acromegalic patient was admitted to the Clinical Center, Bethesda, Md., after six months of anorexia, nausea, and epigastric pain, with signs of high intestinal obstruction. Fifteen years earlier pyelolithotomy was performed for a left renal calculus and three additional stones were passed spontaneously in the same year. Pituitary irradiation and partial hypophysectomy had been performed for visual signs of pituitary tumor ten years prior to admission. Gastrointestinal studies showed partial obstruction of the third portion of the duodenum and gastric aspiration yielded fluid in excess of 10 liters per twenty-four hours. Wedge resection was performed for a jejunal ulcer which had perforated into the transverse mesocolon, and lysis of adhesions freed an internal hernia producing obstruction at this site. At this time cortisone therapy was instituted and continued for a period of two months. Approximately six weeks later signs of high intestinal obstruction recurred and contrast studies revealed complete obstruction of the third portion of the duodenum.

At surgery there were found an acute ulcer in the first portion of the duodenum, large nodes producing extrinsic pressure on the duodenum, and a nodule of tissue in the head of the pancreas. A subtotal gastrectomy and antecolic gastrojejunostomy were performed and Menetrier's disease was diagnosed from

the surgical specimen. Hematemesis occurred three days after gastric resection, and total gastrectomy, esophagojejunostomy, and jeunojejunostomy were subsequently performed for penetrating ulcers about the gastrojejunostomy site. The patient died a few weeks after the third operative procedure, from esophagojejunal anastomotic line disruption and resultant peritonitis.

At autopsy, an islet-cell tumor was present in the duodenal wall and multiple islet-cell tumors were scattered throughout the pancreas. Other findings were chromophobe adenoma of the pituitary, functioning parathyroid adenoma and hyperplasia of the other parathyroid glands, multiple adrenal cortical adenomas, multiple follicular adenomas of the thyroid, and metastatic islet-cell tumor in the periportal and pulmonary hilar lymph nodes.

Comment: This case demonstrates the rapid course and fatal termination of the intractable ulcerative disease of the upper gastrointestinal tract in spite of extensive resection. Adenomas involved the islet cells, pituitary, parathyroids, adrenal cortex, and thyroid. The osseous changes were consistent with acromegaly and hyperparathyroidism. The alterations in the duodenal mucosa, coarsening and thickening of the folds, were clinically attributed to inflammatory disease, and steroid therapy was instituted.

CASE VII (Fig. 7): M. K., a 41-year-old female, was admitted to the White Plains Hospital (White Plains, N. Y.) because of nausea, vomiting, abdominal cramps, and weight loss of four months duration. At the onset of symptoms, contrast studies of the upper gastrointestinal tract, including the small intestine, were considered to be within the range of normal. Re-examination during the initial hospitalization showed changes which were believed to be those of partial duodenojejunal obstruction, and the patient was treated by gastric suction. Gastric hypersecretion was marked, abundant free acid and blood were demonstrated in the gastric aspirate, and blood was noted in the stools. Metacorten was given for suspected regional enteritis over a period of two weeks prior to surgery, when a perforated jejunal ulcer with a large walled-off abscess was found. Because of adherence of jejunal loops to the splenic flexure, a jejunal resection with end-to-end anastomosis and gastrojejunostomy were performed. Diarrhea developed, and the abdomen was re-explored two weeks later because of persistent vomiting uncontrolled by gastric suction. Efferent limb obstruction was secondary to kinking of the bowel and adhesions. One week following the second operation the patient died suddenly after complaining of chest pain.

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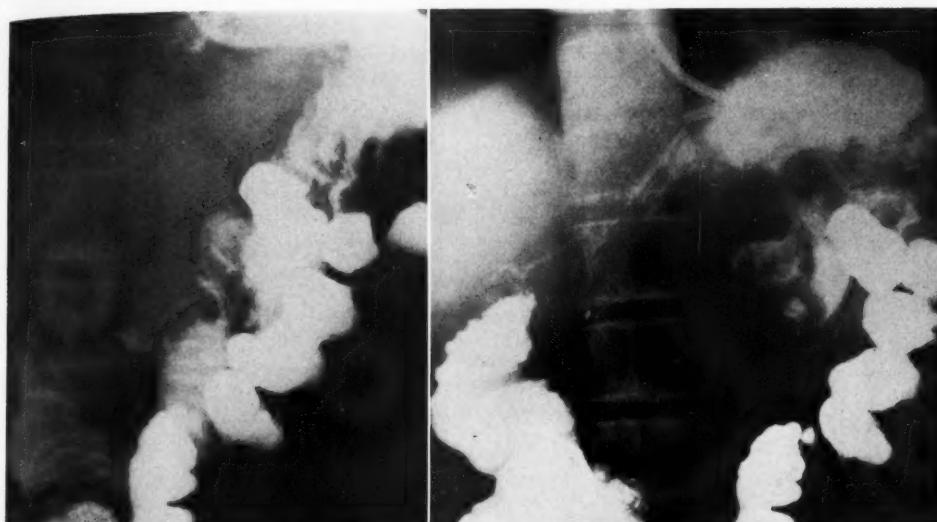


Fig. 6. Case VI. Marked gastric hypersecretion with contrast studies performed during the course of intermittent aspiration of fluid. The megaduodenum, second portion, and the large folds are striking. Residual barium is present in the colon from previous contrast studies. The changes in the lumbar vertebral bodies are secondary to the effects of hyperparathyroidism and acromegaly.

Autopsy showed multiple large, ragged ulcerations in the lower esophagus, stomach, duodenum, and upper jejunum, with little induration. A large ulcer in the duodenum and several in the jejunum were of longer duration; there were associated induration, scarring, and penetration into the pancreas. The esophageal ulcer had perforated into the pleural spaces. One of the gastric ulcers had excavated into the liver. An islet-cell tumor was found submucosally in the wall of the duodenum about 1.0 cm. distal to the pylorus. The duodenum was dilated, with friable and hemorrhagic mucosa as well as an ulcer on the posterior wall of the second portion, medial to the ampulla of Vater.

Comment: This case illustrates the unrelenting course of the ulcerative disease in spite of surgical therapy. The patient had received corticosteroids for suspected regional enteritis. In addition to multiple penetrating ulcers, an islet-cell tumor was found in the duodenal submucosa at autopsy. There were no histopathologic studies of the parathyroid glands or pituitary.

DISCUSSION

A review of the published and several unpublished cases of endocrine adenomatosis associated with ulcerative disease in the upper gastrointestinal tract and small

intestine has established valid roentgenographic criteria by which this condition may be suspected preoperatively. While the ulcers and the pattern of fold enlargement in the stomach are nonspecific, the composite of such changes together with those in the duodenum and jejunum are sufficiently characteristic to warrant a diagnosis of endocrine adenomatosis. These include the presence of ulcerations variously located throughout the duodenal loop, an atonic megaduodenum which frequently arouses the suspicion of organic obstruction distally, marked fold enlargement especially in the second portion of the duodenum, marginal irregularities due to actual ulcers or collections in the interstices between the folds, and nodular defects suggesting a mural location of the islet-cell tumor. Ulcers in the duodenum in the region of the ligament of Treitz or distally in the jejunum, especially when prominence of the fold pattern and rigidity of the wall are present, are highly suggestive of this syndrome.

From the roentgenographic standpoint, the changes in the duodenum and jejunum have been frequently misinterpreted in

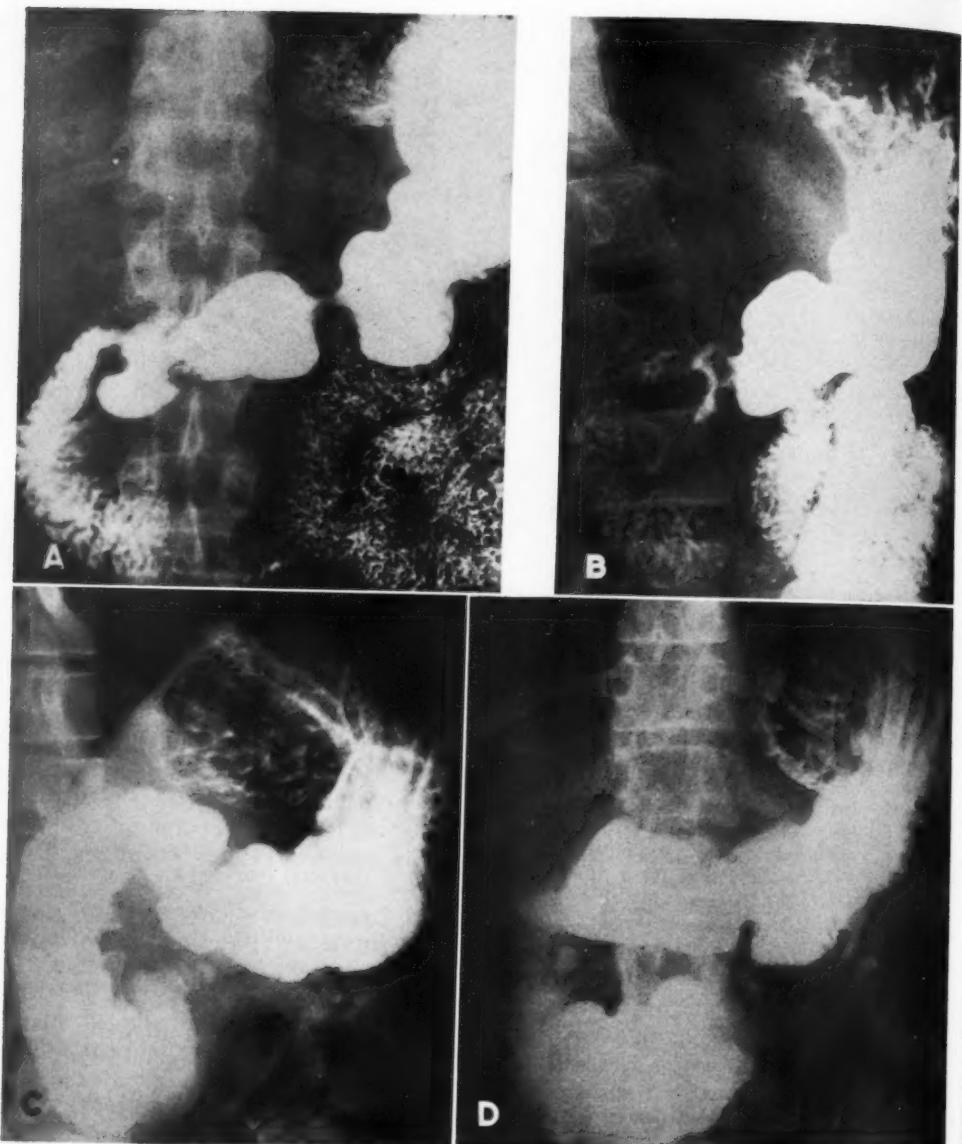


Fig. 7. Case VII. A and B. Duodenal deformity secondary to ulcerative disease; mucosal pattern of the second portion of the duodenum is normal.

C and D. Progressive changes on interval contrast studies showing widening of the lumen of the duodenum, stasis of barium within the loop, and narrowing in the third portion. The folds which can be seen are prominent and there is a soft-tissue mass in the region of the ligament of Treitz which is due to local peritonitis following perforation of a jejunal ulcer.

both the published and unpublished cases. These alterations have been confused with so-called nonspecific inflammatory disease, as mentioned by Fisher and Flan-dreau (10), or with regional enteritis of

the duodenum, as recorded in this series of cases. On the basis of the rigidity of the jejunal walls one of the cases reported elsewhere was interpreted as carcinoma of the jejunum. Steroid therapy based on a

misdiagnosis of nonspecific or regional enteritis has led to unfortunate consequences, such as reactivation of ulcers and perforation.

In our experience, these patients seek medical care for various facets of the syndrome. Some present with signs of anterior pituitary insufficiency or acromegaly; others with hyperparathyroidism, occasionally with clinical manifestations of urinary tract calculi; still others with the varied features of hyperinsulinism. In some, the gastrointestinal signs and symptoms of ulcer, including pain, perforation, hemorrhage, and obstruction, have predominated, while in Jackson's series attacks of recurrent pancreatitis were the striking feature. A clinical picture of sprue or one of profuse watery diarrhea and hypokalemia are fragments of the gastrointestinal-endocrine syndrome which has been recognized with increased frequency. Nevertheless, the findings observed radiologically in the upper gastrointestinal tract may serve to direct attention to the correct diagnosis of endocrine adenomatosis, with avoidance of the pitfalls inherent in misdirected therapy. This does not imply an unrealistic approach to the diagnosis of peptic ulcer in terms of a component of this syndrome, since the majority of ulcers bear no relationship to endocrine adenomatosis.

SUMMARY

1. The gastrointestinal manifestations of the endocrine adenomatosis syndrome are of the utmost importance from the standpoint of management and ultimate prognosis. In order to avoid certain predictable pitfalls in therapy, an accurate diagnosis is imperative.

2. The diagnosis may be made from the roentgenologic appearance of the upper gastrointestinal tract and small intestine. The criteria for such a diagnosis have been presented.

3. Seven cases of endocrine adenomatosis with gastrointestinal manifestations have been analyzed.

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SUMMARIO IN INTERLINGUA

Alteraciones del Vias Supero-Gastrointestinal in Adenomatosis del Glandulas Endocrin

Es describete un syndrome que ha, como componente fundamental, tumores de varie glandulas endocrin e ulcerationes peptic de curso irrelentabile. Le glandulas interessate es principalmente le pituitario anterior, le parathyroides, le insulas de Langerhans, e—minus frequentemente—le adrenales e le thyroide. Le patientes se presenta al consulta medical pro varie aspectos del syndrome: Signos de insufficientia antero-pituitari o acromegalia, hyperparathyroidismo — occasionalmente con manifestaciones de calculos in le vias urinari—o varie characteristicas de hyperinsulinismo. In certe casos, le signos gastrointestinal e le symptomas de ulcere es predominante, o recurrente attaccos de pancreatitis es le aspecto le plus frappante.

Le manifestaciones del syndrome de adenomatosis endocrin es del plus grande importantia ab le punto de vista del

tratamento e del ultime prognose. Durante que le ulcres e le allargamento del plicas in le stomacho non es specific, insimul con le alteraciones in le duodeno e le jejun illos es sufficientemente characteristic pro justificar le diagnose de adenomatosis endocrin. Le alteraciones duodenal e jejunal include le presentia de ulcerationes in varie sitos del ansa del duodeno, un megaduodeno atonic, marcate allargamento de plica, specialmente in le secunde portion del duodeno, irregularitates marginal causate per le ulcres mesme o collectiones in le interstitios inter le plicas, e defectos nodular que suggere un sito mural del tumores de cellulas insular. Ulcres in le duodeno in le region del ligamento de Treitz o distalmente in le jejun, specialmente quando le conformation del plicas es marcate e le pariete es rigide, es forte indicios del presentia de iste syndrome.

The Roentgen Diagnosis of Eighth Nerve Tumors¹

ALFRED L. SCHMITZ, M.D., and SAMUEL B. HAVESON, M.D.

APPROXIMATELY 6 per cent of all intracranial neoplasms are acoustic neurinomas. Though histologically benign, clinically these tumors often have a malignant course due to their large size in a critical area by the time the diagnosis is finally established.

Cushing (1) noted that the symptomatic progress of the average acoustic tumor occurred more or less in the following stages: first, auditory and labyrinth manifestations; second, occipitofrontal pains with suboccipital discomfort; third, incoordination and instability of cerebellar origin; fourth, evidences of involvement of adjacent cerebral nerves; fifth, indications of an increase in intracranial tension, with a choked disk and its consequences; sixth, dysarthria, dysphagia, and finally cerebellar crises and respiratory difficulties. Olivercrona and Nielsen (2), Olsen and Horrax (3), Edwards and Paterson (4), and Pool and Pava (5) all reported series of cases which corresponded rather closely to Cushing's description. On the other hand, only 31 per cent of Dandy's series (6) followed Cushing's chronology exactly. The most common variation was that 5th nerve or cerebellar involvement followed 8th nerve involvement. However, headaches, occipital pain, or some occipital discomfort preceded even the auditory manifestations in 12.4 per cent.

It must be noted that almost all acoustic neurinomas are rather large by the time they are diagnosed, and symptoms and signs are not limited to 8th nerve involvement. The following statement made by Cushing, in 1917, holds true today. "It would be ideal could the lesion be recognized when the *acusticus* alone is involved, that is, before there is evidence of implication of the other structures in the recess, but so many disorders may cause tinnitus,

labyrinthine vertigo and deafness that until the otologist comes to our aid and helps to differentiate the various conditions which occasion these symptoms, we are not likely to recognize *in vivo* the acoustic tumors at this early stage."

At the stage in which the diagnosis is usually reached, the average acoustic neurinoma presents no diagnostic difficulty, although atypical cases occur which are great problems. It may be stated that when a patient with an acoustic neurinoma is seen for initial x-ray examination after clinical work-up, the clinician will indicate that there is involvement of the cerebello-pontine angle and in most instances he will suggest a probable acoustic neurinoma. Rarely, an acoustic neurinoma will be clinically localized outside of the cerebello-pontine angle, but in that instance the tumor will be large enough to produce clinical signs that will lead to a contrast study, which will localize the lesion correctly.

Mention has repeatedly been made of the intimate relationship between 8th nerve tumors and the internal auditory meatus since the earliest description of the tumors. In 1777, Sandifort (7) described a probable acoustic neurinoma arising from the 8th nerve. He noted at that time that the tumor was "insinuating itself into the foramen as an obstruction in the internal os of the petrous portion of the temporal bone, which said nerve enters." Subsequently, Charles Bell (8) in 1830, Weiglein (9) in 1840, and Cruveilhier (10) in 1835-1842 described undoubted acoustic tumors with clinical notes and postmortem findings. The latter two authors observed erosion of the internal auditory canal. Henschel (11), on the basis of his cases, believed that the tumors invariably arose from the distal part of the nerve, usually within the inter-

¹ From The Department of Radiology, University of California Medical Center, San Francisco, Calif. Presented at the Forty-fifth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Nov. 15-20, 1959.

nal auditory canal. This view was supported by Cushing's observation that all of the few early tumors encountered up to that time had a distal origin. He speculated that, if a series of temporal bones from asymptomatic patients were sectioned, some early tumors would be found. Subsequently, Hardy and Crowe (12) did serial sections in 250 cadavers and discovered 6 acoustic tumors which had not given rise to clinical symptoms. The tumors were so small and deep in the internal canal that they were overlooked at autopsy and at the time the gross specimens were described in the laboratory. The vestibular nerve was involved by 4 of the tumors and the cochlear nerve by 2. The largest tumor was 5 mm. in diameter and the smallest 0.25 mm. These findings, together with previous gross pathologic observations, tend to confirm the fact that most acoustic neuromas have a distal origin.

Alagna (13) reported the first case of acoustic neuroma in which it was specifically stated that there was no extension of the tumor into the porus. Henschen (14) later described 2 cases with an unusual location in the proximal portion of the nerve. In one of the patients, hearing was found not to have been completely lost on examination shortly before death, and in both the disturbances of hearing had been late rather than inaugural symptoms. In neither case was the porus dilated nor did the tumor project into the auditory canal. Cushing also had a case (#7) in which examination of the entire surface of the tumor showed no point of attachment of growth within the porus. The acoustic symptoms were definitely recorded as late rather than early manifestations, and it was felt that in all probability this tumor arose from the intracranial portion and not from the intracanalicular portion of the nerve. It is well known that tumors of the peripheral nerves may reach tremendous size without appreciably interfering with the transmission of nervous impulses and their function, even when impaired, may be resumed after enucleation of the growth. Thus, it is probable that an acoustic tumor originating in the

proximal and free portion of the nerve would be capable of much greater enlargement without disturbance of function than if the fibers suffered compression from within the bony canal. A unilateral acoustic neurinoma with a medial origin may be clinically undistinguishable from a neurinoma of the 5th nerve, since the latter growth may cause identical cranial nerve involvement with a similar delay in auditory and labyrinth disturbances (15).

Henschen first pointed out that, since the growth often originates from that portion of the nerve which lies within the canal, a distended internal meatus or porus could be shown by x-ray. Enlargement of the internal auditory meatus was first demonstrated with the Schüller technic, which superimposes the shadow of the internal auditory meatus on that of the external auditory meatus, the principal ray transversing the length of each canal. This method was found to be unreliable. Chamberlain (16) advanced our diagnostic ability in 1926 when he demonstrated definite erosion of the petrous bone by acoustic tumors, utilizing the now well known Chamberlain-Towne projection.

In Cushing's and other earlier series, plain films were found to have only corroborative value. At the present time, with a personally directed and detailed study based on previous contributions on evaluation of the petrous bone, it is possible to show tumor changes in approximately 85 per cent of cases (17, 18). Since most acoustic tumors originate in the internal auditory meatus, this structure is our primary concern. The meatus is at least 2 cm. removed from the petrous apex (Fig. 1), and changes in the apex are due to an advanced lesion which can eventually destroy large parts of the petrous bone and may extend to destroy the dorsum sellae on the side of the tumor. Secondary bone changes attributable to increased intracranial pressure can also occur.

In the study of the internal auditory meatus, that structure should be projected free of all confusing bony densities. Furthermore, the meatus should be studied with

multiple views in which the central ray passes through the canal tangentially. Three projections are utilized: (a) the Lysholm (19) modification of the Stenvers view, (b) the Chamberlain-Towne antero-posterior projection, and (c) the basal projection. For proper detail, small cones and well exposed films are necessary. In the Lysholm modification of the Stenvers view, the head is placed in a true lateral position with the petrous pyramid to be examined next to the film. The tube is then angled, instead of the head. This guarantees reproducibility and exact comparison of the two sides with the petrous pyramid close to the film. For the Chamberlain-Towne projection, the orbitomeatal line is perpendicular to the tabletop and the tube is angled. If too little angulation is used, the sphenoid wings and anterior clinoids are superimposed over the internal auditory meatus; with too much angulation, the structures of the jugular foramen are superimposed over the internal auditory meatus (Fig. 2). The correct angle to bring the internal auditory meatus into profile varies for the individual skull. If the orbitomeatal line remains perpendicular to the tabletop, one can easily vary the tube angulation by 2 or 3° in one direction or another until a satisfactory projection is obtained.

For the basal projection of the meatus, the head should be extended approximately 5 to 10° less than in a true basal view. The internal auditory meatus thus is projected just anterior to the arch of C-1, free of confusing superimposed bony structures. If the internal auditory meatus is posterior to the arch, too much extension has been used. All films should be viewed immediately and repeated until the internal auditory meatus can be studied in multiple projections free of other bony parts. The variation in the configuration and size of the internal auditory meatus has been previously described by Camp (20). We have also found variations in the size of the midportion of the two canals in normal individuals, with a difference as great as 3 mm. in some cases. The shape



Fig. 1. Specimen with lead wire around the petrous apex and in the internal auditory meatus. Apex is 2 cm. removed from the internal auditory meatus.

rather than the size of the internal auditory canal is the critical factor in the evaluation of changes due to tumor. The normal internal auditory meatus usually has the appearance of a flask in the modified Stenvers and Chamberlain-Towne projections, with the opening or porus of the meatus to the intracranial cavity being narrower than the body of the internal auditory canal. The walls of the canal may at times be parallel but are almost never funnel-shaped with the porus being the widest (Fig. 3, A, B, C). On the other hand, a funnel appearance in the basal views is the rule, straight walls are found in the minority of cases, and a flask appearance is almost never seen.

The first change in the internal auditory meatus due to acoustic neuroma is an erosion of the bony wall. The upper wall

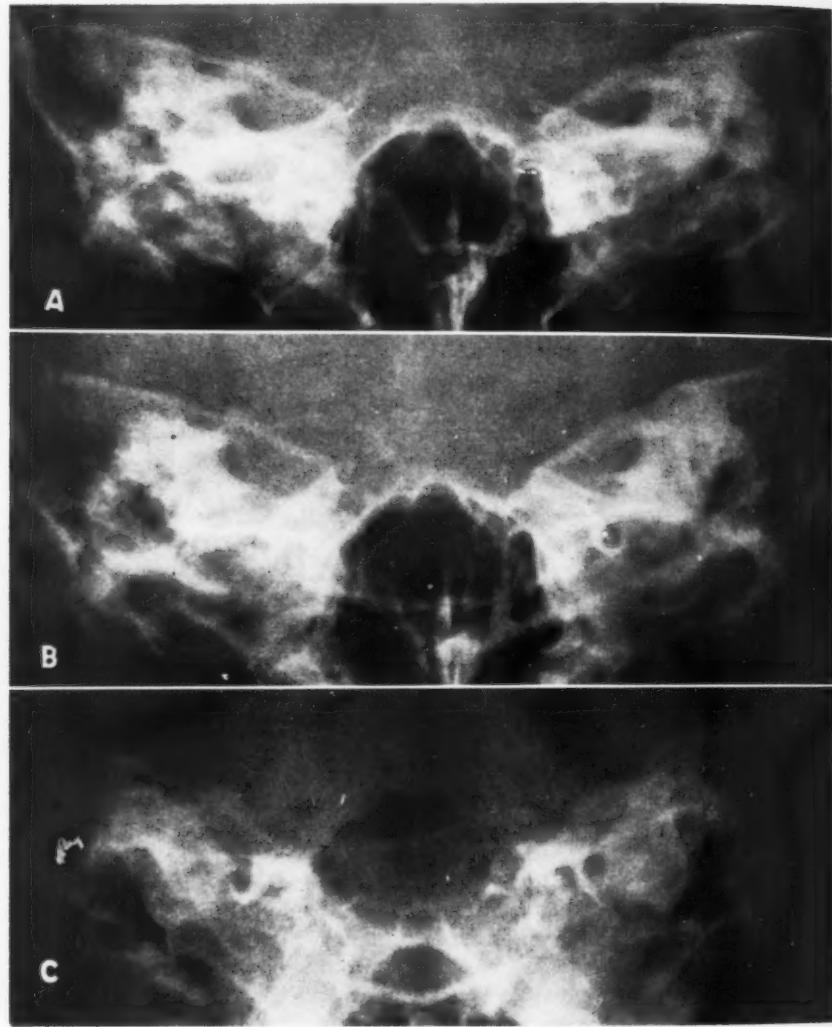


Fig. 2. Chamberlain-Towne projections. A. Too little angulation; sphenoid ridge projected in the internal auditory meatus. B. Satisfactory projection. C. Too much angulation; jugular foramen over meatus.

shows pressure erosion and it appears as though sandpaper had been applied to its under surface, producing a spicule formation rather than the soft curve of the normal upper border which drops down to narrow the canal at its outlet. This is best visualized in modified Stenvers and Chamberlain-Towne projections. The erosion of the bone obviously reflects the direction of growth of the tumor, and the site of the bony changes indicates that these tumors

tend to grow out of the canal with the greatest pressure superiorly and posteriorly at the outlet (Fig. 3, D, E). This is where the bone is thinnest in the normal meatus. The depth of the canal and its lower borders are involved much later but eventually the whole of the meatus (Fig. 4) and surrounding petrous bone can be destroyed. The basal view shows destruction of the posterior medial wall of the porus as the earliest finding (Fig. 5). Although the

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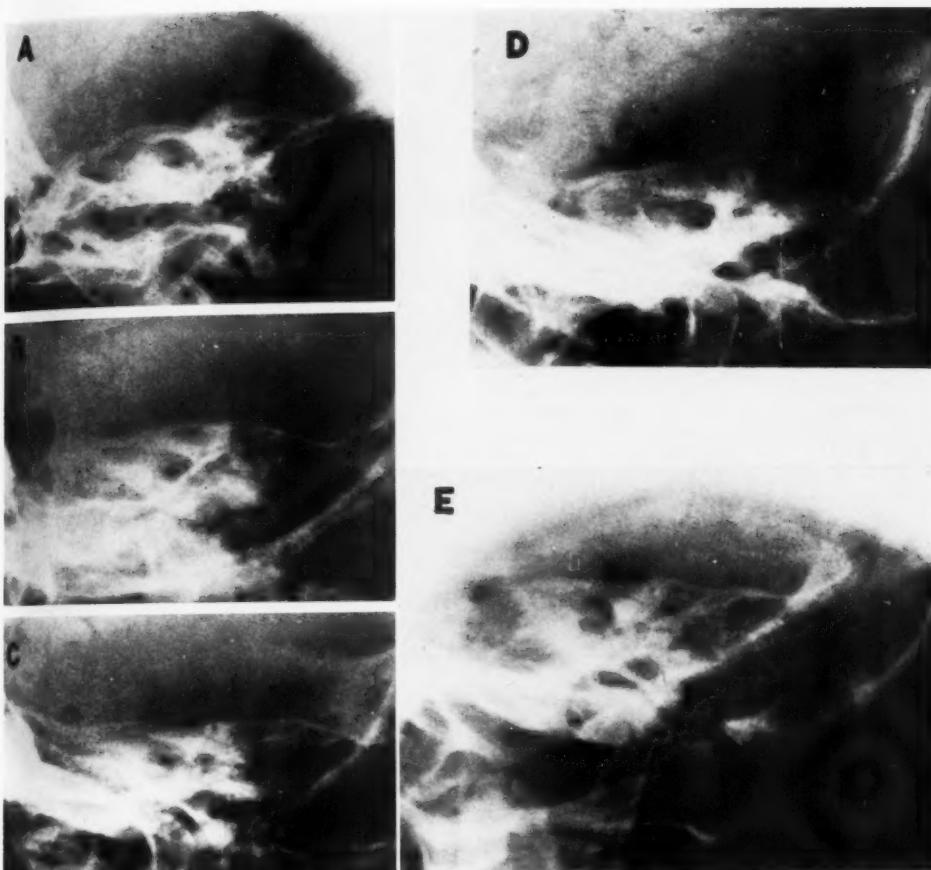


Fig. 3. A. Normal flask-shaped internal auditory meatus. B. Normal parallel walls. C. Normal slight funnel shape. Unusual variant which would need contrast study for complete evaluation. D. Tumor erosion of the upper posterior border of the meatus. E. Marked tumor erosion of the upper posterior border of the meatus.

basal view is of important supplementary value in evaluation of the full extent of the tumor, it would be unusual to find diagnostic bone changes limited to the basal view. Changes in the internal auditory meatus are hard to evaluate in this projection, since it normally has a funnel appearance and the tumor merely makes this larger. There is no alteration in configuration unless the posterior medial border is definitely destroyed.

On occasion, a tumor may grow in the depth of the internal auditory meatus without widening the porus but only causing the deep portion of the canal to become large and round. This type of tumor

is extremely hard to diagnose in its early stages. There may sometimes be a slight funnel appearance of the internal auditory meatus on the modified Stenvers and Chamberlain-Towne projections without definite bony destruction (Fig. 3, C). In our opinion, such borderline cases must be examined by pneumoencephalography if an 8th nerve tumor is suspected. Lindgren (17) states that, of 158 surgically verified cases, 147 had bone changes. Obvious changes permitting a definite diagnosis were demonstrated in 65 per cent of the cases. In another 20 per cent the changes were of a kind to suggest the diagnosis of an acoustic tumor. In this latter group, the results

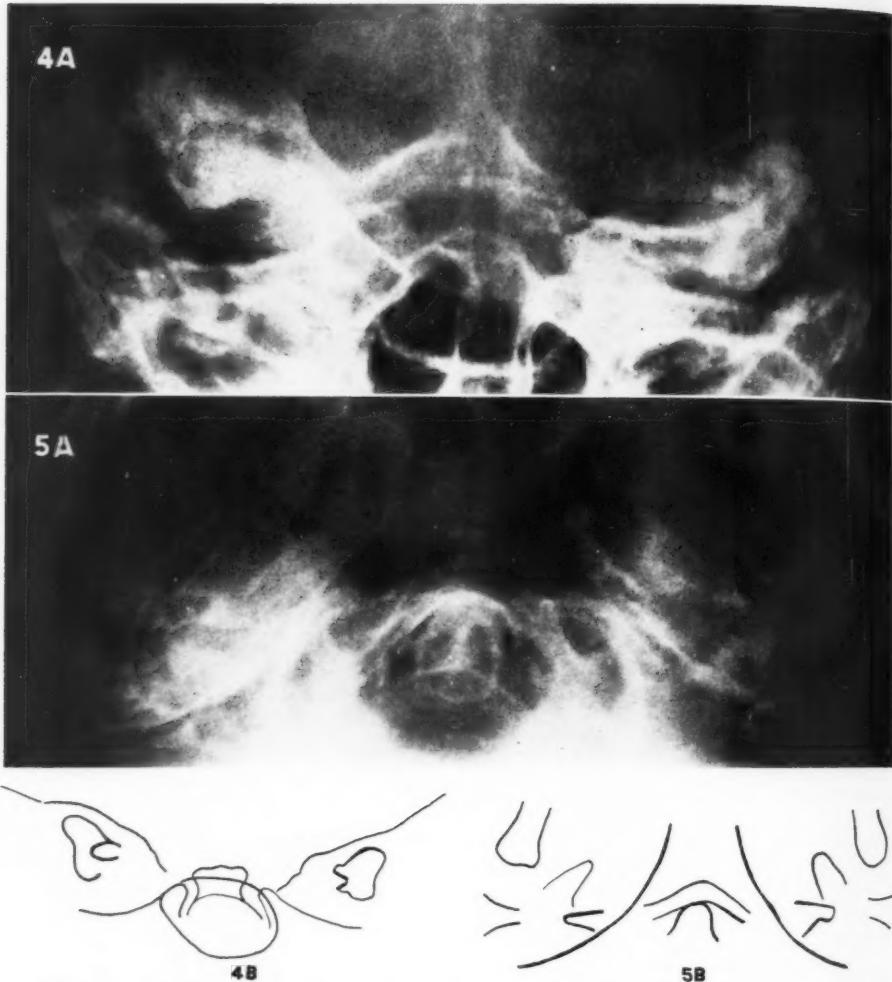


Fig. 4. The major portion of the left internal auditory meatus is destroyed.

Fig. 5. Basal projection. Right internal auditory meatus has a normal funnel shape. The left meatus shows destruction of the posterior medial wall.

of the roentgen examination with conventional films had to be combined with the clinical findings, or an encephalographic examination, in order to obtain a definite preoperative diagnosis.

Unilateral erosion or widening of the internal auditory meatus has been considered pathognomonic of acoustic neurinomas by Lindgren (21). We have observed 2 cases, one an undifferentiated malignant growth and the other a clivus meningioma, in which the tumor extended into the internal

auditory meatus, causing widening and erosion.

CASE I: R. S., a 19-year-old male, was admitted to U. C. Hospital May 13, 1957, with a history of headaches, hearing loss in the left ear, and difficulty in coordination of the left arm and leg, all of which had been present and progressive for one year. Physical examination revealed involvement of the 5th, 7th, 8th, and 9th cranial nerves on the left side with ipsilateral cerebellar ataxia and incoordination.

A diagnosis of left cerebellopontine lesion was made and a cerebellar exploration revealed a tumor. The cerebellar tonsils could be seen to be herniated,

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and immediately beneath them lay a tumor which had also herniated through the foramen magnum. The inferior part of the left cerebellar hemisphere was resected in order better to visualize the tumor. This was well seen laterally and had a free and smooth border. Medially it was adherent to the brain stem and to the overlying cerebellar hemisphere. The superior extent of the tumor was never seen. It was possible to visualize only the 9th, 10th, and 11th cranial nerves on the left side. A biopsy was taken. The microscopic diagnosis was "unclassified malignant tumor" (Fig. 6).

CASE II: M. F., a 50-year-old white female, was admitted to U.C. Hospital March 30, 1959, complaining of easy fatigability for the past six months. Two to three months prior to admission she had experienced increased weakness in her legs and cold and numb feelings followed by progressive weakness in the hands and arms. Over the six-month period she occasionally had trouble in swallowing, with liquids coming out of her nose. The weakness was progressive, so that at the time of her admission she was unable to walk and could barely use her hands.

General physical examination was negative. There were definite papilledema on the right, blurring of the nasal border on the left, nystagmus to the right of the left lateral gaze, and vertical nystagmus in upward gaze. Also present were bilateral depression of the corneal reflex, diminished sensation over the trigeminal distribution bilaterally, a suggestion of right facial hemispasm and left facial underactivity, diminished hearing (possibly bilaterally), sluggish gag reflex, and possible fibrillations of the tongue. Weakness and wasting were observed throughout the upper extremities, more pronounced on the right. The deep tendon reflexes were active with asymmetrical patellar reflexes, the left being more active than the right. Hoffmann and Babinski signs were present. Abdominal reflexes were absent. Sensation was impaired only in the 5th nerve bilaterally. Position sense was intact.

An occipital craniotomy on June 5 showed that the cerebellar tonsils and vermis were not herniated. The left cerebellum rapidly protruded through the opening in the dura. The medulla and cervical medullary junction were pushed backward from the tumor to an extreme degree. The tumor was reddish gray and bled easily. Portions were removed. It was impossible to demonstrate a communication from the lateral ventricle to the 4th ventricle, and a Torkildsen procedure was done.

The patient died postoperatively, and postmortem examination revealed a large meningioma arising from the clivus and extending into and destroying the left internal auditory meatus (Fig. 7).

PNEUMOENCEPHALOGRAPHY

The ventricular system of the posterior fossa usually fills during pneumoencephal-

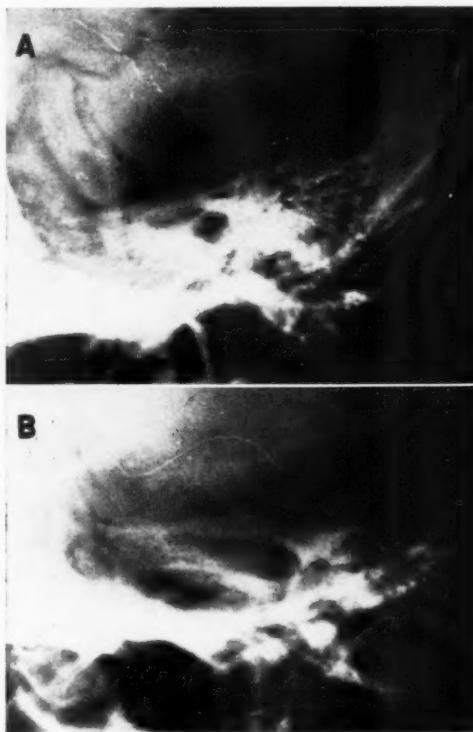


Fig. 6. Case I. A. Normal right meatus. B. Left meatus wide and eroded. Unclassified malignant tumor.

lography in the presence of an acoustic neuroma. The tumor displaces the aqueduct and 4th ventricle posteriorly and upward and also to the healthy side. The 4th ventricle, as a rule, is more strongly displaced than the aqueduct and according to Twining (22) frequently is also somewhat rotated. Large tumors may displace the aqueduct so far posterior that the pressure against the tentorial edge produces a complete occlusion between the aqueduct and 4th ventricle. These tumors may also become large enough to cause a posterior displacement and elevation of the posterior portion of the 3rd ventricle. Ecker (23) showed that this indicates an upward transtentorial herniation of the brain stem and cerebellum due to tumor. The vein of Galen may be compressed and stretched by the herniating roof of the cerebellum pushing upwards through the tentorial notch. It has been suggested by Stopford (24)

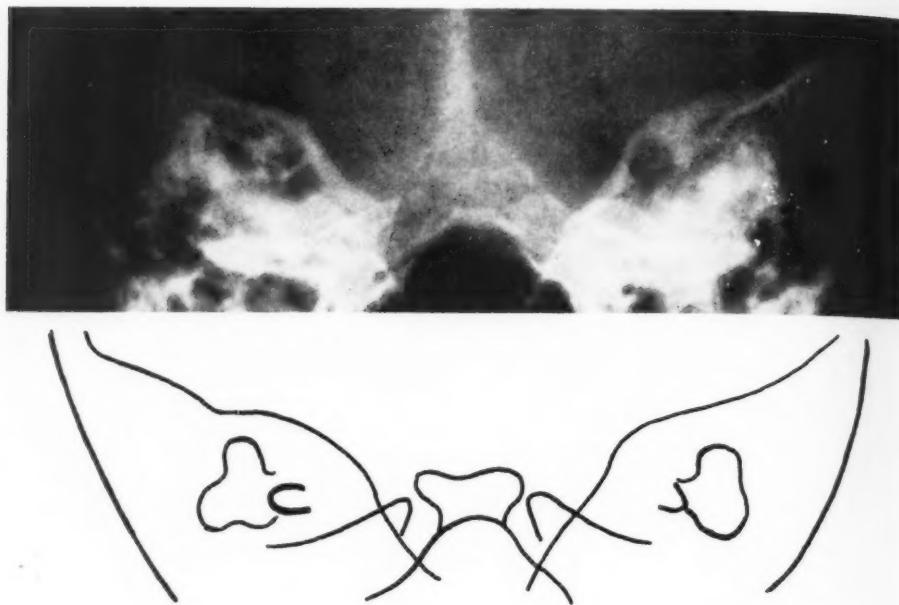


Fig. 7. Case II. Destruction of the left internal auditory meatus. Clivus meningioma.

that increased intracranial pressure might result from this compression. The basal veins of Rosenthal may be distorted by the brain stem rotation.

The extracerebral location of the tumor can be demonstrated only by a study of the cerebellopontine angle cisterns. Small tumors which do not cause displacement in the ventricular system from the midline can be diagnosed only by demonstration of the tumor in the cerebellopontine angle cistern on the involved side. As the acoustic nerve passes from the internal auditory canal to the brain stem, it courses through a space below the tentorium in the posterior fossa known as the cerebellopontine or sub-tentorial angle (25). This space is bounded above and laterally by the sloping rigid tentorium, below and laterally by the sloping posterior surface of the petrosa, and above and medially by the inferior surface of the cerebellum and side of the pons; it is about 1/2 inch in width and 1 inch in depth. It contains cerebrospinal fluid and a fine network of trabeculae which stretch from the arachnoid on the bone to the pia mater on the cerebellum and pons. Crossing this

space are the 5th, 7th, and 8th nerves, the nervus intermedius, and the anterior inferior cerebellar artery and vein.

During pneumoencephalography, after the 4th ventricle and aqueduct have been demonstrated on right-angle projections, the patient's head is extended and 8 c.c. of air is rapidly injected to fill the cerebellopontine angle cisterns. A film is immediately exposed with the head in the Chamberlain-Towne position except that the central ray enters in a postero-anterior direction. The earliest cerebellopontine angle tumors can be outlined by air over the entire tumor. As the tumor enlarges, it conforms to the resistant pyramidal bone on one side, to the base of the posterior fossa below, and the tentorium above. On the free side it crowds the rather unresisting cerebellum, brain stem, and cerebral nerves, displacing these structures away from the so-called angle. Eventually, the tumor engulfs the acoustic nerve and may envelop the facial nerve as well, thus causing difficulty in determining the origin of the lesion. The contour of the larger tumors can become

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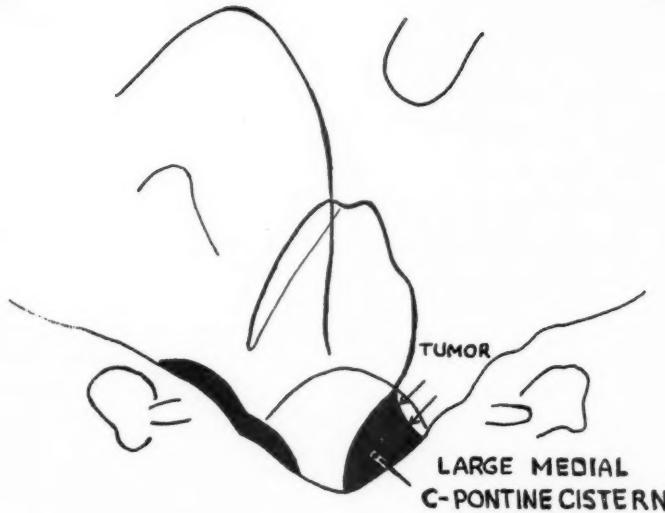


Fig. 8. Acoustic neurinoma in the left cerebellopontine angle cistern. The lower medial border of the cerebellopontine angle cistern is larger than usual.

more or less irregular as they conform to the walls of the posterior fossa, and nodules may develop which deeply indent the side of the pons and medulla.

It is evident that air cannot be seen over the entire surface of a large tumor which is intimately in contact with the brain stem. In such a case, the lower

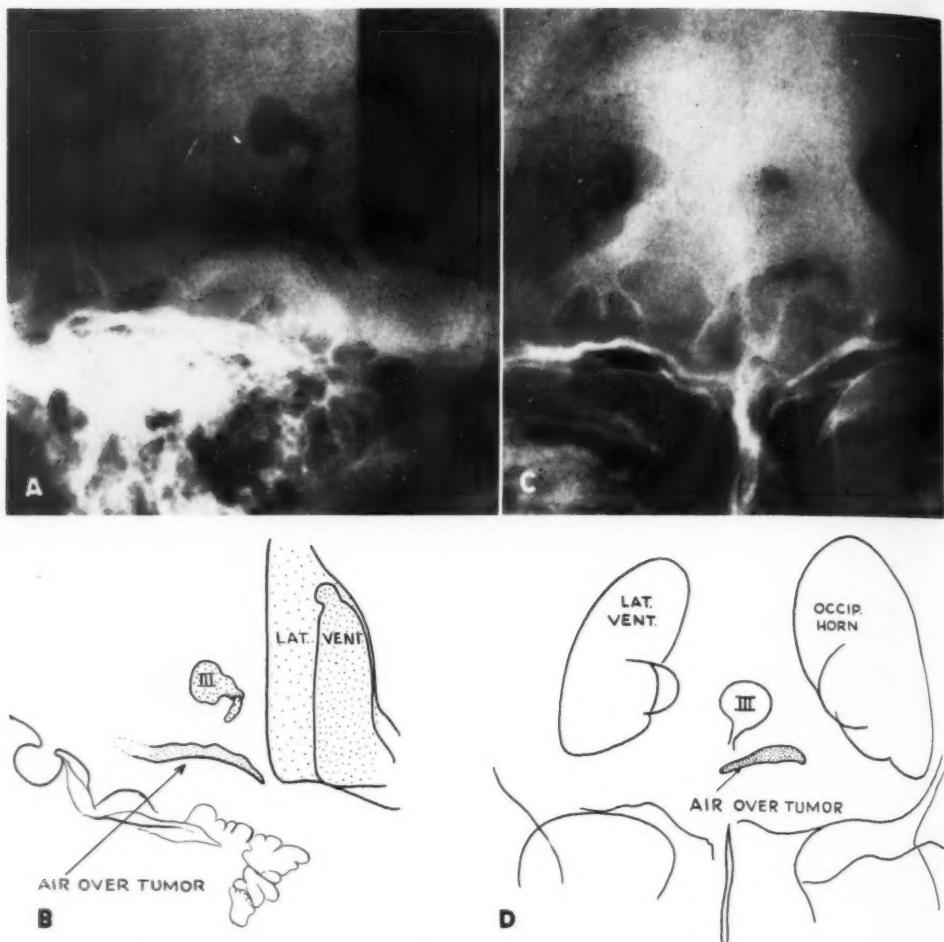


Fig. 9. A and B. Air over an acoustic neurinoma on lateral projection. C and D. Air over the tumor in the postero-anterior projection.

border of the tumor may be visualized as a mass obliterating the lateral aspect of the cerebellopontine angle cistern and presenting a sharp rounded medial border. It is important to note that the whole cistern is not compressed. In fact, the visualized lower medial portion is larger than usual, since a bigger space is created in this area by the pressure of the tumor against the brain stem laterally and superiorly (Fig. 8). Air at times may also be seen over the superior surface of the tumor on the postero-anterior projections. Occasionally, an air shadow may be seen

representing the upper lateral surface of the tumor on lateral projections (Fig. 9). This information can be utilized to observe the direction of growth of the tumor, e.g., an extension up into the tentorial slit can at times be identified (Fig. 10). Tumors in this area can impair the flow of cerebrospinal fluid in its course through the pontine and ambient cisterns. Olivecrona (26) has urged removal of the upper pole of the tumor from the incisura tentorii in order to re-establish the fluid pathways. This is a difficult area to visualize surgically, and an encephalo-

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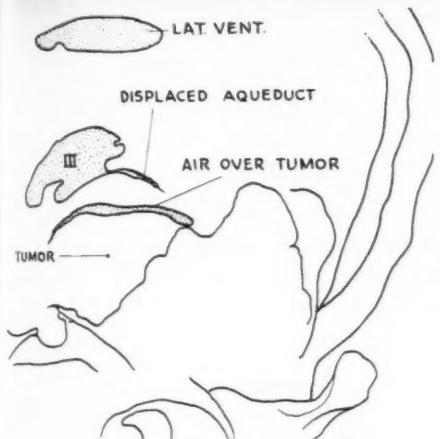


Fig. 10. Air over the tumor, which extends up into the tentorial slit.

graphic evaluation of the extent of the tumor up into the tentorial slit is of great value. Nonfilling of the cerebellopontine angle cisterns on repeated attempts will not allow a conclusion as to the presence or absence of tumor (Fig. 11). The tumor itself or ventricular displacement must be seen for a definite diagnosis.

Acoustic neuromas are the commonest tumors of the cerebellopontine angle. There is usually a definite chronology with a relatively characteristic clinical picture due to primary involvement of the 8th nerve, with cochlear, vestibular, and trigeminal nerve signs. A combination of

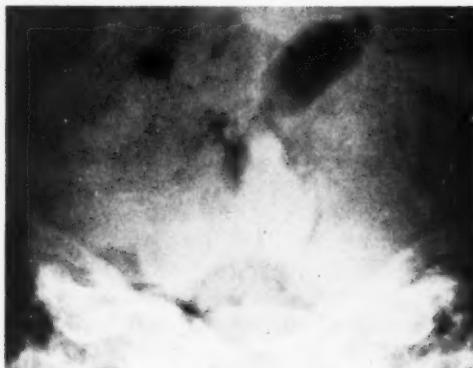


Fig. 11. Nonfilling of the left cerebellopontine angle cistern after repeated attempts. No diagnosis was possible in this instance.

these findings and changes in the bony walls of the internal auditory meatus leads to an almost certain diagnosis. Meningiomas, cholesteatomas, and gliomas in the region of the cerebellopontine angle can in rare instances, however, give similar findings and, as our case reports have indicated, may even cause erosion of the internal auditory meatus. Erosion of the meatus, therefore, cannot be regarded as pathognomonic of an acoustic nerve tumor. Pneumoencephalography is quite reliable in demonstrating an extracerebral tumor in the cerebellopontine angle. The preoperative prediction of the histologic nature of these tumors is less reliable, even when the entire clinical picture and laboratory findings are taken into consideration.

Of considerable interest are tumor size and stage and clinical symptomatology at the time of diagnosis of acoustic nerve tumors. Olivecrona has stated that "the diagnosis or rather the ability of the non-specialist to recognize the acoustic tumors in their early stage has not improved much. We still receive most of our patients with acoustic tumors in a very late stage of development, nearly all of them with choked discs and not a few of them blind or with vision much reduced. Almost without exception a large tumor is found at operation, and our records contain only a single incidence of a very

early tumor where the only symptoms were a loss of hearing and an enlarged porus, and the patient came under neurosurgical observation only because he was fortunate enough to have a few vertiginous attacks of Menière's disease." In Dandy's series, as reported by Revilla (15), the average weight of the solid contents of the tumor was 27.6 gm., the smallest weighing 2 gm. and the largest 55 gm. In Cushing's series the long axis of the tumor varied between 2.5 cm. and 7 cm. It is therefore evident that, when these patients are initially examined in the x-ray department, their tumors are likely to be quite large. The size is reflected in the finding of demonstrable bony changes on plain films in 85 per cent of cases. Almost all tumors at this advanced stage are easily recognized by pneumoencephalography, but considerably smaller tumors could be detected by this means. It would appear that earlier diagnosis would be enhanced by a method to arouse clinical suspicion when involvement is still confined to the 8th nerve.

SUMMARY

1. The clinical features and gross pathology of acoustic tumors are briefly reviewed.

2. The plain film changes are described, with stress on an individualized examination in every case.

3. Unilateral erosion of the internal auditory meatus is not pathognomonic of acoustic neurinoma.

4. Pneumoencephalographic findings are reliable enough to enable one to diagnose small extracerebral tumors in the cerebellopontine angle. The evaluation of tumor extension into the tentorial slit is discussed.

5. These tumors are usually advanced when clinically recognized. Radiologic techniques are available, however, which could probably detect tumors at an early stage if clinical suspicion were aroused when involvement is limited to the 8th nerve.

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SUMMARIO IN INTERLINGUA

Le Roentgeno-Diagnose de Tumores del Octave Nervo

Neurinomas acustic, ben que illos es histologicamente benigne, pote sequer un maligne curso clinic in consequentia de lor dimensiones e de lor location in un area critic. Quando le diagnose es finalmente estableite, le affection se ha usualmente extendite in ultra del octave nervo.

Pelliculas ordinari exhibi alterationes tumorali in circa 85 pro cento del casos. Pro demonstrar le interne meato auditori, in le qual le majoritate del tumores prende lor origine, tres projectiones es usate: Le modification Lysholm del vista Stenvers, le projection antero-posterior Chamberlain-Towne, e le projection basal. Le prime alteration in le meato auditori es erosion del pariete ossee, reflectente le direction del crescentia del tumor e indicante que iste lesions tende a crescer ex le canal, con le pression maximal in le direction superior e posterior al exito. In le curso del tempore, le integre meato e le circumjacente osso petrose pote esser destruite.

Erosion unilateral o allargamento del interne meato auditori es considerate per

certe investigatores como pathognomonic pro neurinoma acustic, sed con iste opinion le presente autor non se trova de accordo.

Le systema ventricular del fossa posterior se replena usualmente durante le studio pneumoencephalographic in caso que neurinoma acustic es presente. Le aqueducto e le quarte ventriculo es displaciante posteriormente e in alto e verso le latere intacte. Le location extracerebellar del tumor pote esser demonstrate solmente per un studio del cisternas del angulo cerebello-pontin. Le tumor mesme pote esser delineate in le position Chamberlain-Towne per le aere a su superficie. A vices il es possibile identificar un extension a in le fissura tentorial.

Quasi omne le tumores es facilmente recognoscibile in le pneumoencephalogramma al tempore del examine initial. Es opinate que plus micre tumores essera etiam recognoscibile e que un plus precoce diagnose devenirea possibile si le suspicion clinic poteva esser stimulate durante que le affection es ancora restringite al octave nervo.



Intercostal Lung Bulging, an Early Roentgen Sign of Emphysema in Children¹

S. SCHORR, M.D., and D. AYALON, M.D.

THIS PAPER deals especially with the roentgenographic findings in overexpansion of the lung parenchyma, characterized by intercostal bulging of lung tissue with increased radiolucency of the affected areas. Normally the line separating the bright lung from the intercostal soft tissue is straight or even slightly concave. Convexity or outward bulging of this borderline appears to indicate overexpansion of the lung, the so-called "air trapping" or acute emphysema of children.

MATERIAL AND METHODS

The series upon which our study is based consists of a total of 77 patients from the pediatric wards. These patients were resubmitted, during our investigation, to repeated clinical and roentgenographic examinations.

The *control group* consisted of 50 infants and children between the ages of sixteen days and twenty months, who were admitted to the hospital because of illnesses not affecting the respiratory tract; only children who had no history and no clinical evidence of respiratory disease were included in this group. Chest roentgenography was performed in the antero-posterior and postero-anterior positions, in the crying and non-crying state. In the first 5 cases, films were obtained with the patient upright (anteroposterior and postero-anterior), prone, and recumbent, but as no significant radiological difference was found between these positions, the remaining cases were examined in the prone and recumbent positions only.

RESULTS

The *pathological group* consisted of 27 children, ranging in age from a day to three years, who had been hospitalized

because of respiratory tract disease or in whom it developed during their stay in the hospital. These cases were selected because of the presence in the chest roentgenograms of marginal lung overexpansion in the intercostal spaces, with or without other roentgenographic pathological pulmonary findings. Five cases of this group came to autopsy (Table I).

In Normal Group: Of the 50 control cases, 4 were found to show intercostal overexpansion of the lung parenchyma. Further investigation of the case histories revealed the presence of respiratory disease in 3 of the 4, *i.e.*, spastic bronchitis, pneumonia, and upper respiratory tract infection. These 3 cases were accordingly transferred to the pathological group comprising positive cases with a history of respiratory infection. Thus only 1 case in the control group showed intercostal bulging and localized increased radiolucency of the lungs without any respiratory clinical findings and was therefore considered a false positive.

In Pathological Group: 1. In 22 out of a total of 27 cases in the "pathological group," signs of overexpansion of the lung parenchyma appeared on the roentgenograms simultaneously with clinical and other roentgen evidence of acute inflammatory processes in the respiratory tract (Figs. 1 and 2).

2. In a total of 18 cases, intercostal overexpansion of the lung parenchyma was associated with other roentgenologic signs of pulmonary emphysema. The intercostal overexpansion appeared either before or after the other signs of emphysema were detected (Fig. 3).

3. In 6 cases parasternal intercostal bulging was observed on the lateral chest roentgenogram. In 2 cases parasternal intercostal bulging of the lung paren-

¹ From the X-ray Department of the Municipal Hospital "Hadassah," Tel-Aviv, Israel. Accepted for publication in January 1960.

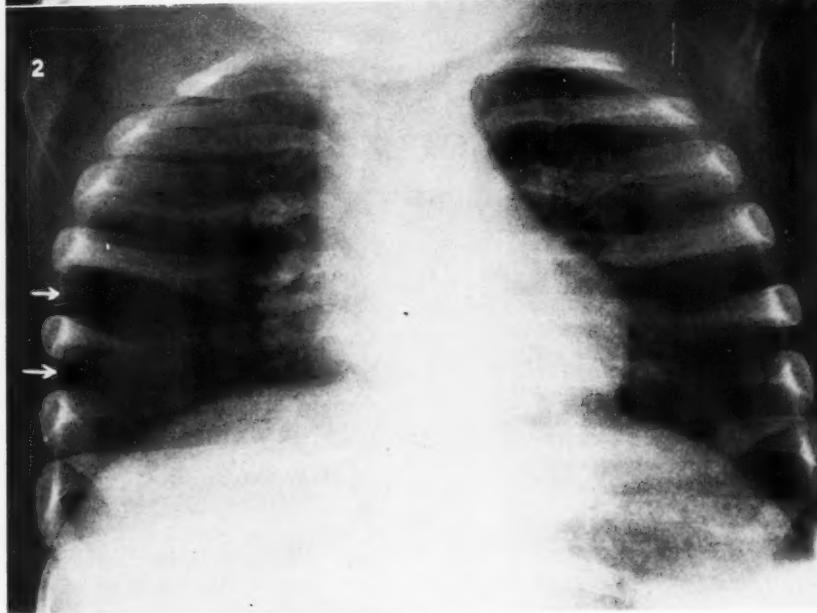
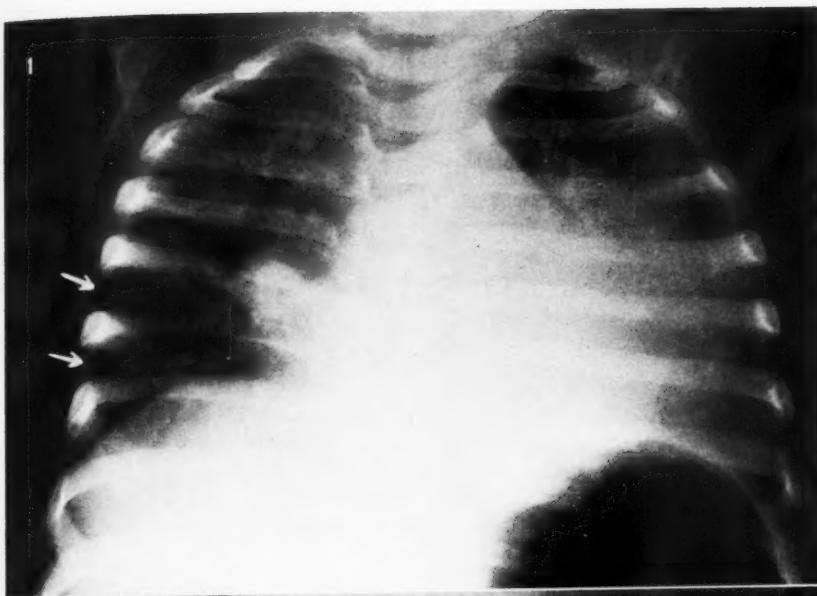


Fig. 1. S. S., age 12 months. Dyspnea, cough, and fever one week before admission. Chest roentgenogram (anteroposterior erect) showing inflammatory changes in the left and right lung parenchyma. Note marked intercostal bulging, especially in the 5th and 6th right intercostal spaces, with marked radiolucency (arrows).

Fig. 2. S. T. A., 6 weeks of age. Dyspnea and oral cyanosis six days before admission. Note moderate intercostal bulging in the 4th and 5th right intercostal spaces (arrows). Compare with the normal straight outline of the left peripheral lung border.

TABLE I: POSTMORTEM FINDINGS IN 5 CASES FROM THE PATHOLOGICAL GROUP

Case No.	Clinical Findings			Roentgenological Findings				Postmortem Findings
	Age	Past History	Clinical Diagnosis	Apical Herniation	Anterior Mediastinal Herniation	Peripheral Intercostal Herniation		
1.	3½ months	Cough, fever, dyspnea, cyanosis one day before admission	Bronchopneumonia, Pulmonary emphysema	...	...	Right lung	Acute tracheitis, acute purulent bronchitis and bronchiolitis, bilateral bronchopneumonia, acute emphysema of lungs
2.	5 weeks	Diarrhea, dyspnea one week before admission	Methemoglobinemia, pulmonary abscess, paralytic ileus	Present left lung	...	Left lung	Right hemorrhagic bronchopneumonia with abscess formation and emphysema (left side)	
3.	9 days	Urinary retention after circumcision	Bilateral hydronephrosis, urethral stricture, megureter	...	...	Left and right lungs	Bilateral patchy bronchopneumonia, acute emphysema of lungs with subpleural blebs, stricture of prostatic urethra, bilateral hydronephrosis with abscess formation
4.	8 days	Dyspnea, cough, and cyanosis two days after delivery	Obstructive emphysema, hydrocephalus, cerebral hemorrhage	...	Present	Right and left lungs	Internal hydrocephalus, thrombosis of longitudinal sinus, emphysema of the lungs, bilateral aspirations into trachea and bronchi	
5.	1½ months	Vomiting, cough, dyspnea, cyanosis, two days before admission	Terminal bronchopneumonia, suspected myocarditis	...	...	Left lung	Bilateral interstitial pneumonia, emphysema of the lungs with subpleural bleb formation

chyma was present simultaneously with peripheral lateral intercostal bulging as seen in the anteroposterior view (Fig. 4).

4. Postmortem examination was performed on 5 cases. In all of these, both macroscopic and microscopic pulmonary emphysematous changes were present. In 1 case multiple costal impression markings on the lungs due to severe peripheral emphysematous changes were found (Fig. 5A). These costal lung impressions corresponded anatomically to the intercostal bulging seen on the chest roentgenograms obtained one day before the patient's death (Fig. 5B).

5. In 7 cases intercostal overexpansion of the lung parenchyma was shown on subsequent chest roentgenograms to be reversible (Fig. 6).

6. In 5 cases intercostal overexpansion of the lung parenchyma was found without any other radiological findings. These

cases were included in the pathological group because of a history of respiratory tract infection preceding their hospital admission, or because of signs of respiratory tract infection on clinical examination.

DISCUSSION

Van Wezel (15) describes intercostal herniation among other types of acquired pulmonary herniation. He stresses the frequency of intercostal herniation in those suffering from chronic bronchitis and cough, this finding being often associated with widespread pulmonary emphysematous changes. Smith (14) mentions the presence of intercostal pleural bulging as one of the diagnostic clinical signs of respiratory distress in the newborn suffering from the trapped air syndrome. Ariztia *et al.* (1) mention interstitial emphysema, which causes bulging of the lung parenchyma in the intercostal

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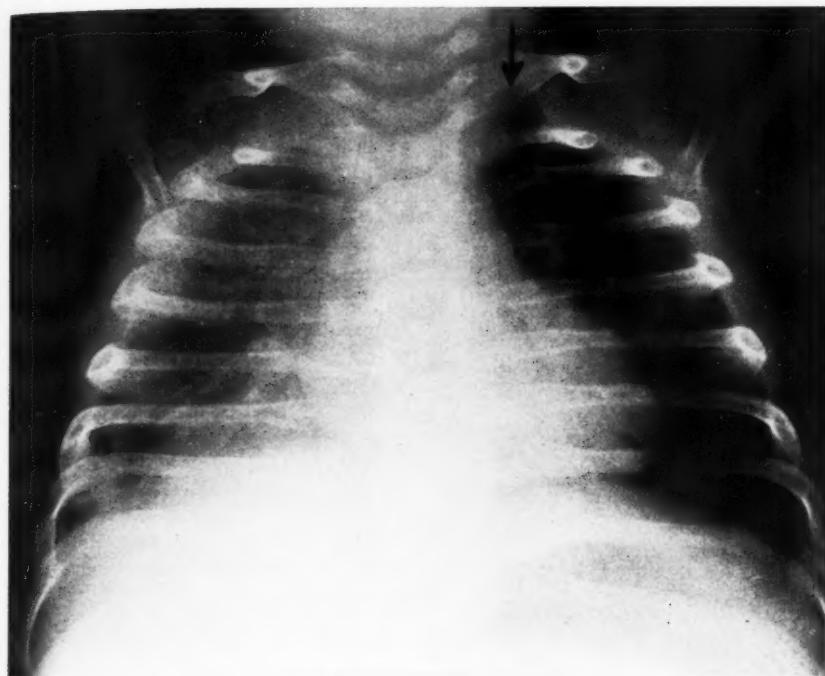


Fig. 3. K. I., 2 months of age. Dyspnea two weeks before admission. Inflammatory parenchymal infiltrations in the right lung. Note emphysema of left lung with apical herniation (arrow) and intercostal bulging especially in 4th and 5th interspaces.

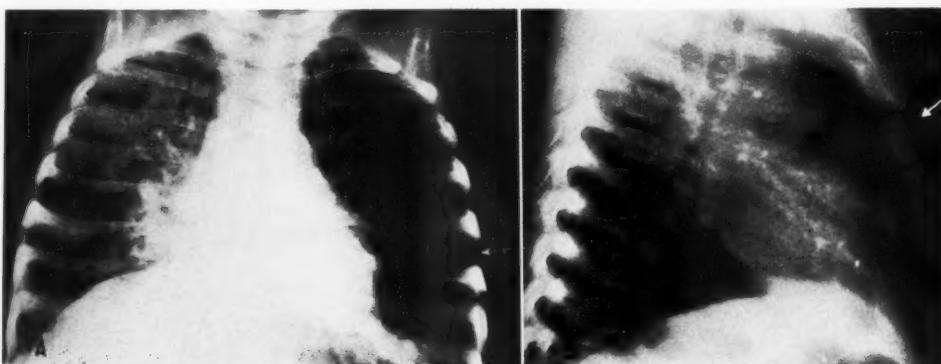


Fig. 4. B. I., 2 months of age. Admission for severe dyspnea and oral cyanosis.

A. Postero-anterior roentgenogram showing pulmonary inflammatory infiltrations in both lungs, notably in the right upper lung field. Note intercostal bulging with marked radiolucency of parenchyma especially in the 5th and 6th intercostal spaces bilaterally (arrow).

B. Lateral view: Note parasternal anterior intercostal bulging of marked degree.

spaces, as one of the typical radiological signs of interstitial plasma-cell pneumonia.

McCrae (8) and Jackson (4, 5) reiterate Laennec's (6) check-valve obstruction theory concerning the basic etiologic mech-

anism of emphysema in order to explain the alveolar air-trapping syndrome which represents the first physiopathological change in the production of emphysema. Along with others (2, 7, 11, 12), they



attempted to adapt the check-valve obstruction theory to all forms of obstructive emphysema. McLean (9) rejects the bronchial check-valve mechanism. On the basis of histopathological studies, he concludes that in every inflammatory process of the lung, the respiratory bronchioles are mainly affected and may be completely obstructed (never partially) because of their small diameter. According to McLean, this bronchiolar obstruction does not prevent aeration of the alveoli distal to the obstruction, because of the presence of the alveolar pores of Cohn, which permit collateral ventilation to the alveoli connected with the obstructed bronchiole. On this basis he divides the mechanism of the production



Fig. 5A. Z.O., age 3 1/2 months. Cough, fever, dyspnea, and cyanosis one day before admission. Postmortem specimen. Note the costal impression on the peripheral lung parenchyma. Pathological findings: emphysema pulmonum, bilateral confluent bronchopneumonia, acute purulent bronchitis and bronchiolitis (M. Loewental, M.D.).

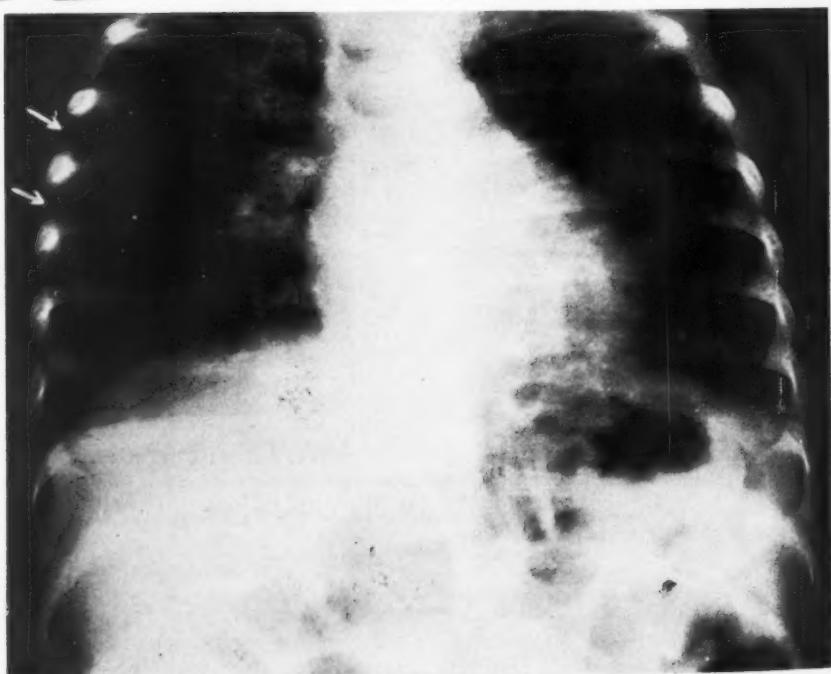
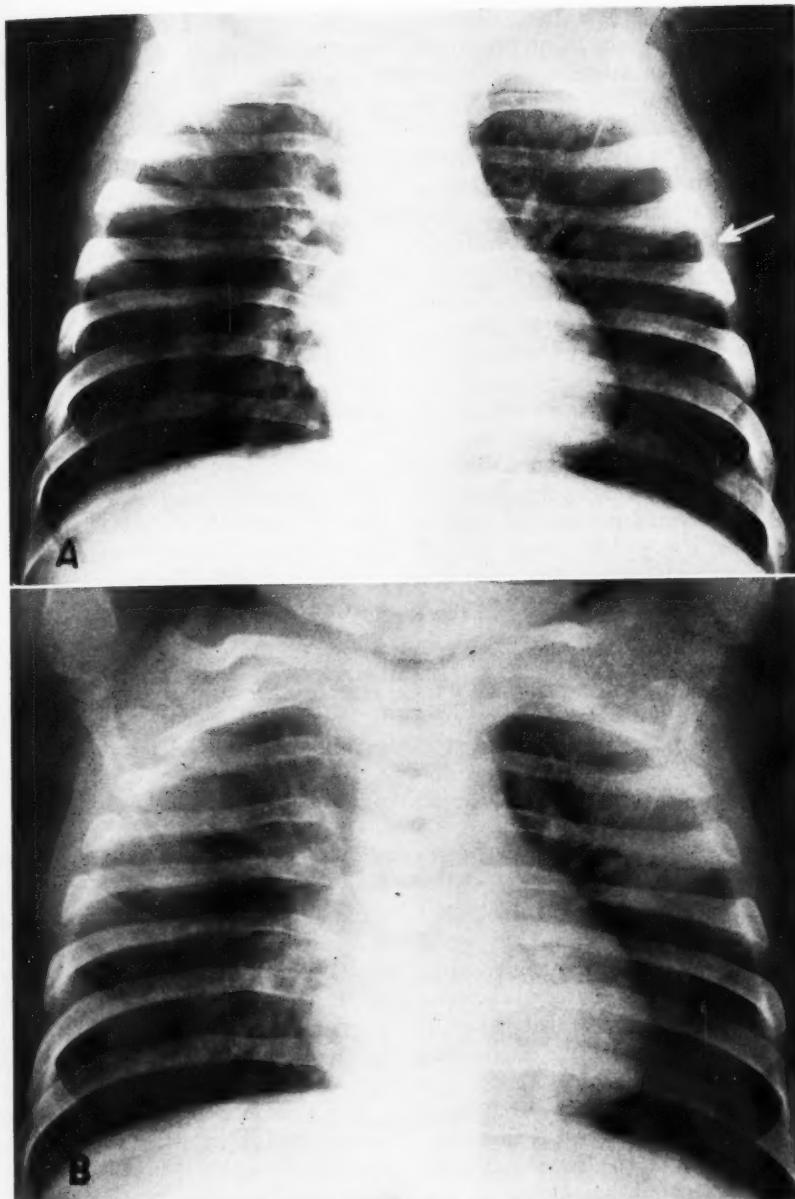


Fig. 5B. Anteroposterior chest roentgenogram taken at admission twenty-four hours before death. The findings are less impressive than seen at autopsy. Note intercostal bulging on right (arrows).

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Figs. 6. D. K., 9 months of age. Cough, dyspnea, and slight temperature elevation three days before admission.

A. Anteroposterior chest roentgenogram, Nov. 30, 1958. Inflammatory infiltration in the right upper lung field. Note intercostal bulging (arrow) with increased radiolucency in the left and right mid-intercostal spaces.

B. Dec. 4, 1958. Straight lung borderline after full recovery indicating reversal of the process.

of emphysema into two stages: Stage 1 is the stage of bronchiolar obstruction by mucous plugs. This stage is reversible, depending upon expulsion of the plug as explained in Stage 2. Stage 2 is the stage of air trapping. The alveoli distal to the obstruction continue to receive air during active inspiration from the neighboring alveoli. During passive expiration only part of the air manages to escape through the alveolar pores because of their minimal diameters, and the volume of air trapped is thus increased. Finally, a stage is reached in which either the compressed air manages to expel the mucous plug, thus permitting a return to normal, or the increased intra-alveolar pressure breaks down the walls of the neighboring alveoli, producing an irreversible emphysematous process. Thus every infectious process in the lung may leave areas of microscopic emphysematous change resulting from bronchiolar obstruction.

It seems to us that peripheral overexpansion of the lung as indicated by its intercostal bulging is a patho-entgenologic expression of emphysema of the peripheral layers of the parenchyma, due to a temporary obstruction of the small bronchioles (Grade 3-4) by mucous plugs or inflammatory edema of the bronchiolar mucosa. The reversibility of the peripheral overexpansion is shown by the fact that the intercostal bulging is seen on serial roentgenograms to disappear even after only a short time has elapsed between examinations (Fig. 6). McLean (9) stresses the reversibility of emphysematous processes due to obstruction. Mayer and Rappaport (10) emphasize the frequency of emphysematous changes in the newborn and infants and the reversibility of these changes in most of their cases.

Oderr, Pizzolato, and Ziskind (16) in their paper "Emphysema Studied by Microradiology" demonstrated three types of emphysema: central, diffuse, and peripheral zonal types. The last of these might well correspond to the marginal intercostal bulging demonstrated radiologically in this study.

We may assume that the appearance of the roentgenologic sign of intercostal overexpansion of the lung parenchyma without other patho-entgenological findings may indicate the presence of inflammatory processes in the respiratory tract which otherwise are subclinical and sub-entgenologic.

With a single exception, which cannot be entirely explained, chest roentgenograms of our control group, in anteroposterior and postero-anterior projections (prone and recumbent positions), in the crying and non-crying state, revealed no intercostal bulging. According to Dayman (3), bronchioles may act as check valves in the expiratory phase of respiration even in healthy lungs.

It is notable that the sign described above, namely, lateral intercostal bulging, is not mentioned in standard texts such as Caffey (2) and Schmid-Weber (13) although, no doubt, it has been noticed by others. The parasternal bulging, as seen in the lateral view, should be emphasized. We have observed such findings in adults as well. These will be covered in a later report.

SUMMARY

1. In 27 infants and young children with acute respiratory infection, the chest roentgenogram revealed intercostal lung bulging.
2. This phenomenon may be associated with or independent of other signs of emphysema.
3. The emphysema producing this sign is reversible.
4. The lateral chest film may reveal parasternal intercostal bulging, not always accompanied by bulging of the lateral intercostal spaces.
5. In 5 autopsied cases the diagnosis of acute pulmonary emphysema was verified. In one of these, signs of intercostal bulging on the chest roentgenogram were confirmed by persistent deep costal impressions on the pulmonary surface as a result of severe peripheral emphysematous changes.

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6. The roentgen sign of intercostal bulging indicates overexpansion of the lung due to air trapping or acute emphysema and may be observed even in the absence of other clinical or roentgen signs.

7. This roentgen sign may denote an early stage of lung overexpansion and may be an indication of subclinical lung inflammation.

ACKNOWLEDGMENT: We wish to express our thanks to M. Loewental, M.D., from the Pathological Department, and N. Boger, M.D., and B. Z. Werbin, M.D., from the Pediatric Department of the Municipal Hospital "Hadassah," Tel-Aviv, for help in material and suggestions.

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SUMMARIO IN INTERLINGUA

Convexion Intercostal del Pulmon, un Precoce Signo Roentgenographic de Emphysema in Juveniles

In le roentgenogramma, le linea que separa le area luminose del pulmon ab le molle tissus intercostal es normalmente derecta o mesmo levemente concave. Il pare que un conformatioon convexe de iste linea reflecte un hyperexpansion del pulmon, i.e. le si-appellate "intrappage de aere" o emphysema acute de pacientes pediatric. Iste signo esseva incontrate in 27 infantes e juveniles con morbo del vias respiratori, in 22 in association con indicationes clinic e altere indicationes roentgenographic de acute processos inflammatori in le vias respiratori, e in 5 sin altere anomalitates radiologic. In 18 del casos, hyperexpansion intercostal del parenchyma pulmonar esseva associate con altere signos roentgenographic de emphysema pulmonar.

In 6 casos, convexitate intercostal parasternal esseva demonstrabile in un exposition lateral, non uniformemente accompaniate de convexation peripheric.

Cinque casos esseva studiate post morte, e omnes monstrava alterationes emphysematose pulmonar.

Hyperexpansion peripheric del pulmon, reflectite in convexation intercostal, pare esser un expression de emphysema del stratos peripheric del parenchyma causate per un obstruction temporari del micre bronchiolos con tampones mucose o edema inflammatori del mucosa bronchiolar. Le emphysema in iste casos es reversibile.

Iste signo roentgenographic indica possibilmente un stadio precoce de hyperexpansion pulmonar e signala assi, forsitan, un inflammation subclinic.

Accuracy in Radiotherapy¹

J. H. MARTIN, B.Sc., F.Inst.P., Ph.D., E. A. EVANS, M.I.R., and F. J. ANDERSON, M.I.R.

THE IMPACT OF physics on the practice of radiotherapy has been a very real one and the excellent standard of British radiotherapeutic practice is in no small degree due to the efforts of a distinguished group of physicists which British centres were fortunate in attracting in the early days of the practice of the art. Major advances in the physical and clinical aspects of dosimetry were made in the 1930's and the 1940's. Recent years have seen a great deal of theoretical and experimental work which has refined these early determinations. The outcome of this more recent work has all too often been that radiotherapists ask for a degree of accuracy or place in the physical data a degree of confidence which is not justified by clinical and physical considerations. It is the purpose of this paper to explore the sources of error in delivering a prescribed dose to a given site which may arise between the time when a patient is seen in a clinic and a course of treatment determined upon and the conclusion of that treatment, and to present data and suggestions as to how some of these errors may be eliminated.

Table I shows the main sources of error as they arise in the planning and treatment stages. These will be examined in turn.

Dimensional Errors in Planning: When taking the contour of a patient for antero-posterior and postero-anterior fields, for example, in the pelvis, it is the practice in the authors' Institute to take semi-contours with the patient prone and supine. In most patients, and certainly in obese ones, these two semi-contours do not match up exactly. Differences in the antero-posterior and postero-anterior measurements of the order shown in the table will be found and can lead, if ignored, to errors in dosimetry of

a relatively large order. Some adjustment of the measured semi-contours in relation to bony landmarks can assist in minimizing this error. It is also worth drawing attention to the fact that contours measured on one type of couch may differ substantially from those measured on another. In particular, contours taken on an examination couch in a clinic will differ from those on a treatment couch of harder top in a radiotherapy department. For some conditions, during a course of treatment there will be considerable variations in the dimensions of the patient. Where necessary, it is our practice to reassess at intervals the depth-dose values in such conditions. Nevertheless, errors of the order listed can arise. However, these conditions are often those for which a high order of accuracy is not required.

The accuracy with which the region to be treated can be localized is difficult to assess. Recent developments in tomography, which allow cuts of many different kinds to be taken, make it possible to obliterate the shadows of obscuring structures and to achieve a high degree of accuracy in delineation. It is probably true, therefore, that the normal 0.5-cm. margin allowed around the visible tumour is fairly adequate to ensure that the required region is treated. In some instances, as in the chest region, a greater margin is allowed because of movement caused by breathing during treatment.

Data: Isodose curves are now used extensively in treatment planning, and it is probably possible, where radiologic centres measure their own distributions on their own equipment, to keep the accuracy of these distributions to within 2 per cent. Where, however, as is common, the basic central axis depth-dose data, such as are available in Supplement No. 5 of the

¹ From the Physics Department, Cancer Institute, Melbourne, Victoria, Australia. Accepted for publication in February 1960.

TABLE I: SOURCES OF ERROR IN PLANNING AND TREATMENT

Type of Error	Source	Resultant Error	Remarks
Planning Dimensional	Contours: AP and PA measurements (0.5-2.5 cm.) Contours in clinic and contours in radiotherapy department up to 4 cm. Patient variation during treatment, especially: Ascites Bridge treatment 6 port pelvis Spleens Tumour localization (also alteration of prescription during treatment)	10-25% in dose 25% 15% 15% 10% 4% 10 X 10-cm. field, fall-off at 10 cm. depth = 20% Up to 40 per cent	Time involved in correction. Solution: planning clinic We replan 2 or 3 times 1/2 cases replanned few replanned 1/4 replanned Margin 0.5 cm. normally adequate
Data	Isodose curves Fall-off across field Media		Even crude correction can give error <10%
Radiotherapy Dimensional	Marking up and patient variations during course	See above	Accuracy high in certain sites, e.g., middle ear—error 2 mm.
Dose delivery	Output variations Control variations Data for use of wedge filters and other devices Nominal field size Field flattening (linear accelerator) Bolus Casts	±3% + error in inst. calibration 10% 5% Penumbra 2 mm. ∴ Max. error 4 mm. ±3% 10% good bolus 50% bad bolus 5 mm.	This includes output variation error All measured directly Obtainable with good applicator design

British Journal of Radiology, are used and the distribution is calculated by any of the well known methods, it is likely that the accuracy is not better than 5 per cent. Although it is probably not of as great importance in deep therapy as with softer qualities, it should be noted that discrepancies will result from the differences in filter and kilovoltage combination used to obtain a given half-value layer. Trout and his colleagues (1952) have shown that, for measurements in the range of 1 to 5 mm. Al h.v.l., the kilovoltage and filter combinations can produce variations in depth dose of the order of 15 per cent with a variation of 7 or 8 per cent being quite common.

Except for certain special types of apparatus such as the linear accelerator, the isodose distributions are not flat across their width and, although this is well known, it is all too often ignored when

therapists consider only central axis depth-dose points. The importance of considering this fall-off has been pointed out, in another context, by Fowler and Farmer (1957). They have shown that rotation therapy of the bladder at 250 kv afforded inadequate coverage of the bladder when a six-field technique using the same field sizes gave good coverage. This was due to the "peakiness" of the distribution arising from non-uniformity of the dose rate across the x-ray beam.

Other errors in the determination of isodose distributions may result from the use of greatly elongated fields (ratio greater than 2) or inadequate scatter material. Both these situations have been investigated. Jones (1949) and Emmett (1959) have produced data which enable account to be taken of the effects of rectangular fields.

Isodose distributions are determined in

TABLE II: VARIATION OF BACK-SCATTER FACTOR WITH AREA AND THICKNESS OF UNDERLYING TISSUE (h.v.l. 4.0 mm. Al)

Field Area sq. cm.	Thickness of Tissue in Cm				
	1	2	4	7	11
2	1.015	1.025	1.05	1.055	1.065
3	1.02	1.035	1.065	1.07	1.085
4	1.025	1.045	1.075	1.085	1.10
5	1.03	1.055	1.085	1.095	1.11
10	1.04	1.075	1.105	1.125	1.14
20	1.055	1.09	1.125	1.155	1.185
25	1.06	1.105	1.155	1.18	1.20
30	1.065	1.11	1.16	1.185	1.21
40	1.075	1.12	1.175	1.21	1.225
50	1.08	1.135	1.185	1.22	1.24
100	1.095	1.16	1.23	1.26	1.28
200	1.105	1.165	1.245	1.285	1.31

an infinite phantom and, where the thickness of the part treated is less than this, considerable differences in distribution result owing to the lack of back-scatter (Loevinger *et al.*, 1950). Part of a table derived from experimental data and used in the authors' Institute is reproduced here as Table II, showing that errors in back-scatter factors ranging up to about 20 per cent can arise.

Attention should also be drawn to the deviations from the tabulated depth-dose

data which may arise due to the construction of applicators. The effect on depth-dose distributions of applicator ends is understood. There is little effect on back-scatter (Hospital Physicists Association, 1953) and reproducible corrections for the effect on percentage depth dose can be made (Johns *et al.*, 1952) but the detailed construction of the applicator produces more unpredictable variations (Bradshaw, 1953).

Depth-dose data have, of course, been produced in a tissue-equivalent material, and the problem of how to meet the situation when discontinuities such as bone and air spaces are present has not been dealt with altogether satisfactorily. In the authors' opinion, a complete and accurate solution of this problem will not be obtained, at any rate, in such a form as to be practically usable. It is believed, however, that an approach which is partly theoretical and partly empirical may yield a usable result. The errors which discontinuities may cause and the approach which is suggested will now be indicated.

TABLE III: MEASURED AND UNCORRECTED PLANNED DOSES TO OESOPHAGUS

	h.v.l. = 1.5 mm. Cu		h.v.l. = 4 mm. Cu		2 Mev		24 Mev	
	Planned	Measured	Planned	Measured	Planned	Measured	Planned	Measured
A	41	12	55	37(72)	65	55	96	92
B	30	13	44	42(70)	56	57	93	90
C	27	19	40	53(61)	55	67	90	82
D	27	23	40	61(39)	55	72	90	81
E	22	25	35	67(41)	50	77	89	82
F	46	26	59	67(41)	66	75	98	91
G	50	19	65	57(29)	70	75	100	83
H	41	29	55	70(41)	65	81	96	91
I	19	27	31	69(41)	47	80	88	93
J	20	30	34	70(39)	47	82	87	97
K	22	24	35	60(60)	50	77	89	98
L	35	21	48	55(71)	59	77	94	98
TOTAL	380	268	541	708(595)	685	875	1110	1078
	$\frac{M}{P} = 0.7$		$\frac{M}{P} = 1.3$		$\frac{M}{P} = 1.28$		$\frac{M}{P} = 0.97$	
	$\left(\frac{M}{P} \text{ human} = 1.1 \right)$							

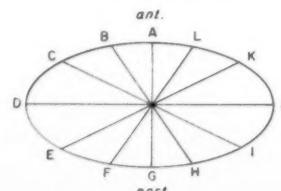


Table III presents some data taken from the work of Smithers (1954), who made some measurements in the oesophagus during rotation of a phantom exposed to x-ray beams of various energies. The rotation therapy distributions have been considered for convenience of computation as twelve separate fields as shown at the bottom of the table. The dose to the oesophagus for each beam of x-rays has been computed from standard depth-dose data and is listed under the columns headed "Planned." The corresponding figures read off Smithers' graphs are listed under "Measured." In one instance, at h.v.l. 4 mm. Cu, measurements were made on a patient, and these are shown in parenthesis. The final ratio of measured dose to planned dose is shown at the foot of each column.

It will be clear from later information, and it is also stated by Smithers himself, that his phantom was not entirely satisfactory from the point of view of representing the various tissues. This is particularly so at the softer quality of 1.5 mm. Cu h.v.l. To some extent, therefore, the picture presented must be relative rather than absolute. Again, the field sizes used by Smithers and his group were small, which tends to accentuate the differences involved. It will be apparent, however, that very large differences exist between the planned and measured values. It is obvious that, at the softest quality, the biggest differences come where the field passes through a large mass of bone, as, for instance, the sternum. It is also interesting to see how, as the energy of the x-radiation goes up, the large volume of less absorbing material represented by the lungs gradually becomes more important than the bone of the ribs.

In Table IV are listed the results of Smithers' measurements, together with similar data obtained from the work of O'Connor (1956), Nielsen (1952), and Thoms, Madsen, and Nielsen (1953).

If we now consider the results of measurements in the oesophagus, it will be seen that the error in dosimetry may be as high as 80 per cent. The range of error,

TABLE IV: ALLOWANCE FOR LUNG AND BONE:
SOME MEASURED VALUES

h.v.l. mm. Cu	M P	Site	Nature of Measurement	
			Field Area	Medium
1.5	0.7	Chest	10 sq. cm.	Phantom
4.0	1.3	Chest	10 sq. cm.	Phantom
4.0	1.1	Chest	10 sq. cm.	Patient
2 Mev.	1.28	Chest	10 sq. cm.	Phantom
24 Mev.	0.97	Chest	15 sq. cm.	Phantom
1.3	1.65	Chest	75 sq. cm.	Fresh cadaver
1.3	1.6	Chest	75 sq. cm.	Fresh cadaver
1.3	1.8	Chest	80 sq. cm.	Fresh cadaver
1.3	0.85	Skull	25 sq. cm.	Fresh cadaver
1.3	0.85	Pelvis	27 sq. cm.	Fresh cadaver
0.7	0.77	Skull		Phantom
0.7	1.44	Chest		Phantom
0.7	0.82	Pelvis	150 sq. cm.	Phantom
0.7	0.8	Pelvis	75 sq. cm.	Phantom
3.5	1.4	Chest	150 sq. cm.	Phantom

however, is from 40 to 80 per cent, and thus, by using an arbitrary correction of 60 per cent, the actual error is reduced to about ± 20 per cent. Similarly, in the case of the pelvis the gross error may be 20 per cent, but the use of a mean value of say 0.82 for the correction would result in an actual error of only 3 or 4 per cent. It is felt that experimental work of this sort, backed by measurements of transit dose on patients and measurements in all possible body cavities, would lead to the determination of suitable factors which could be modified slightly one way or the other for the individual patient. The work should be further assisted by purely theoretical studies. Such work as that of Burlin (1957), in which measurements are made within and behind a discontinuity in a water phantom would lead to an understanding of the relative importance of the scatter and absorption components of the effect of the discontinuity. Such knowledge for simple geometrical configurations would assist in interpreting measurements on patients.

Another effect due to discontinuities arises from the characteristics of high-energy beams. It is well known that high-energy x-ray beams do not build equilibrium for some distance below the tissue surface. Thus, the amount of energy absorbed by the surface is less than the amount absorbed at a depth equal to the

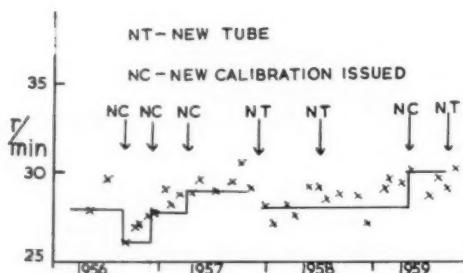


Fig. 1. Output of therapy machine plotted against time.

maximum range of the secondary electrons. In some circumstances, therefore, as in an air cavity of the upper respiratory system, it is possible that inequalities due to lack of build-up may arise (Epp, Lougheed, and McKay, 1958). The effect is not a large one and is obviously energy-dependent. Errors of the order of 10 per cent may arise.

Errors in Treatment: The second section of Table I deals with errors which may occur in translating the planned prescription to the patient in a course of therapy lasting a few weeks. The first group again is dimensional errors. Such errors can arise from variations in positioning of the patient from day to day. They are markedly dependent on the region being treated. For example, around the abdomen the variations can be considerable, owing to differences in compression; around the head and neck, however, the accuracy can be high. In such a site compression is negligible and the most satisfactory beam director of all, the back pointer, is readily usable. As an example, it has been found from serial radiographs that in the authors' Institute the error in setting up a middle ear during the course of a treatment does not exceed 2 mm.

A number of factors affect the accuracy with which the dose is delivered to the patient. Therapy units using radioactive isotope sources, of course, give steady outputs, the accuracy with which the output is known being dependent solely upon the frequency with which it is changed to allow for decay. With equipment using electrical generators, there are variations due to many causes such as electrical varia-

tions, aging of the tube, etc. In this Institute equipment is calibrated once per month; the accuracy of the instruments used for calibration is not better than 2 per cent. Changes in the output figures supplied for treatment are made only if the measured output shows a variation of ± 3 per cent from a mean. It is the practice here to plot the output readings of the machine against time (Fig. 1). This avoids making big changes in the output figures supplied if two successive calibrations should be either side of a mean. Equipment with built-in dose integrating systems is not subject to much error here—only that inherent in the dosimetry system, perhaps of the order of 2 or 3 per cent. A test experiment run on conventional equipment without integrating dose systems was run in this Institute, and over a period of some months the delivered dose did not vary by more than 10 per cent. This figure, of course, includes the error due to output variations mentioned above.

Various devices such as wedge and compensating filters may be put in the x-ray beam. While these may be designed without recourse to measurement, in this Institute all are measured directly so that the error in dose certainly does not exceed 5 per cent.

Considerations affected by field size are usually taken account of in the planning stage, as shown in Table I. It is worth noting here, however, that teletherapy units, that is those using isotope sources, in general have fairly large penumbras. The field size, which is found convenient, therefore, may not correspond to the geometrical delineation of the field. For example, it may be convenient to use the distribution between the 80 per cent contours on either side of the field, or even the 50 per cent contours. Electrically operated equipment, which usually has a fairly small focal spot and where a good design of applicator or diaphragm system is in use, will have penumbra not in excess of 2 mm.

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to fairly large errors because of the uncertainty with which it can be packed to the same volume on each occasion. Errors as large as 50 per cent have been measured (Innes, 1946; Martin and Evans, 1951). Bolus consisting of small spheres, such as the Lincolnshire bolus (Lindsay, 1953) is to be recommended, as with this material errors greater than 10 per cent are most unlikely.

Finally, it should be noted that the dose rate across and perpendicular to the axis of an x-ray tube is not necessarily uniform over fairly wide fields. It has been found practicable in the use of the 4-Mev linear accelerator to keep the flatness of the field to ± 3 per cent over the largest field. On the other hand, Farr (1955) has shown variations due to the effect of filtration in conventional equipment through different designs of tube housing. For example, the predominantly forward emission of the x-rays tends to produce a rise in dosage rate in the side of the field in the direction of the cathode-anode electron stream. The effect is, of course, more marked at large field sizes, where the fall-off can amount to 20 per cent. Farr suggests that the permissible variation across a 25-cm. field should be 10 per cent and states that this could be achieved by proper selection of target angle and design of tube shield.

The foregoing may lead some to doubt the value of isodose distributions. Actually they are of considerable value and represented a great step forward when they were introduced. It will be seen from Table III that, while the errors in their use may be large, they are of the same order for any given site. It follows, therefore, that while all clinical experience was confined to a region around 250 kv, for any one site isodose distributions produced data which could be compared from one set of circumstances to the next. This means, however, that clinical experience has probably been built up on somewhat erroneous dose values. If, therefore, we are to make a true comparison between results in the megavoltage region and in the old 250-kv region, a more accurate

assessment of dose delivered to the site of interest is required. This consideration leads naturally to problems of energy absorption.

The amount of energy absorbed at a particular site of interest depends upon the constitution of the medium and on the photon energy of the radiation, as well as the dose in roentgens to which it has been exposed. It is this situation that led the International Commission on Radiological Units to suggest that a clear distinction be made between the dose to which a medium may be exposed, now termed the exposure dose (roentgens) and the energy actually absorbed in the medium, now termed the absorbed dose (rads). The relative energy absorption picture between bone and soft tissue changes very markedly when the energy of the radiation is raised from 250 kv to the megavoltage region, and it becomes difficult, therefore, to translate the extensive clinical experience at 250 kv to the megavoltage region unless the energy absorption picture is presented. It was this consideration of translating clinical experience from one energy band to another that led to the decision in the authors' Institute to use the rad, and it has now been the unit of dosage here for over three years. The values in use are those recommended for employment throughout Australia (Richardson and Martin, 1957).

Because of the difficulties of measuring directly the energy absorbed, measurements of radiation used on patients are still made with ionization apparatus. It follows, therefore, that the expression of the energy absorbed comes through the measurement of the exposure dose, the relationship being given by the equation $r = f d$. The value of f depends on the material being irradiated and on photon energy of the radiation and it is around the calculation of this factor that the major difficulty in introducing rads lies. It was considered, however, that the inaccuracies in the determination of a suitable value of f were overridden by the consideration of drawing the therapist's attention to

the large changes in energy absorbed involved in moving so far up the energy scale. To avoid the use of the word roentgen in sections of the Institute other than the Physics Department, the output of the x-ray equipment is expressed in rads per minute surface dose for zero area.

SUMMARY

The paper draws attention to sources of inaccuracy in carrying out a treatment prescription in radiotherapy. Some suggestions are made as to means of reducing the inaccuracies and attention is drawn to the value of the rad in utilizing available clinical experience in the 250 kv region for work in the megavoltage region.

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SUMMARIO IN INTERLINGUA

Accuratia in le Radiotherapia

Es discutite le fontes de error que pote interferer in le application de un prescrita dose de radiation a un date sito. Es facite suggestiones con respecto al elimination de certes de iste fontes de error.

Le errores de planation es listate in le duo grupplos de errores dimensional e de errores dependente de datos standard. Le primos concerne mesuraciones de contorno, variationes in le paciente durante le tractamento, e le localisation del tumor. Quanto al secundes, curvas de isodosage calculate super le base de datos publicate exhibi frequentemente discrepancias que se explica per differentias de filtration e de kilo-voltage usate pro obtener un certe spissitate de medie valor. Es etiam a prender in consideration le attenuation del

dose a transverso le campo, errores in le factores del retro-dispersion, e le discontinuitates que es presente in le tissus in consequentia de osso e spatiros de aere.

Le fontes de error que resulta durante le tractamento per se include le sequentes: Errores dimensional del typo causate per variationes in le positionamento del paciente ab un die al altere, variationes in le rendimento del apparato therapeutic, le uso de cuneos e filtros, le dimensiones del campo, materiales de bolo, e applattamento del campo.

Es signalate le importantia del energia absorbite plus tosto que del dose applicate pro le traduction de experientias a 250 kv a region megavoltic.

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Electron-Beam Therapy in the Management of Carcinoma of the Breast¹

FLORENCE C. H. CHU, M.D., ALAN C. SCHEER, M.D., and JORGE GASPAR-LANDERO, M.D.²

BREAST CANCER, its metastases to regional lymph nodes, and chest-wall recurrences are frequent problems which require skillful management. While these lesions are moderately superficial, skin reaction or damage to underlying tissues, particularly to bone and lung, is often the factor limiting the delivery of adequate tumor doses by conventional radiation therapy. Lymph-node metastases or chest-wall recurrences may develop in previously irradiated areas, and the skin changes prevent further treatment by the usual technics. In these circumstances, electron-beam therapy appears to us to offer definite advantages over conventional treatment. The purpose of this paper is to present our preliminary observations in treating 70 patients with cancer of the breast by means of the high-energy electron beam produced by the betatron at Memorial Center (New York).

The following considerations entered into our decision to explore the role of high-energy electron-beam irradiation.

- (1) The electron beam has a sharp fall-off which provides sparing of underlying tissues such as the lung.
- (2) The depth of penetration may be regulated by varying the energy of the electron beam. Figure 1 shows the central axis depth-dose distributions produced by electron beams of various energies. Roughly, for every increase of 2 Mev energy, the effective range of radiation increases by approximately 1 cm. Thus, for treating superficial lesions less than 3 cm. deep, 10.4 Mev energy may be chosen. This will give a high radiation dose to
- (3) the first 3 cm. of tissue and very little radiation to the tissue beyond. On the other hand, when a lesion is slightly deeper or thicker, a higher energy range, *i.e.*, 18 to 22.5 Mev, may be selected for irradiation. The 4 to 5 cm. of tissue adjacent to the skin surface will receive effective radiation while underlying tissues will receive considerably less.
- (4) The maximum dose occurs at approximately 10 to 15 mm. below the skin surface (Fig. 1), effectively reducing skin dose.
- (5) The radiation throughout the tumor is homogeneous.
- (6) There is little or no differential bone absorption.
- Since the total volume of tissue irradiated is reduced, systemic reactions may also be expected to be lessened. This is of importance because many of the patients with advanced cancer of the breast are in poor physical condi-

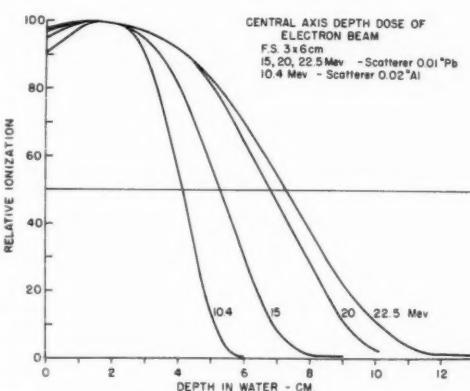


Fig. 1. Central axis depth-dose curves of various energies of electron beam.

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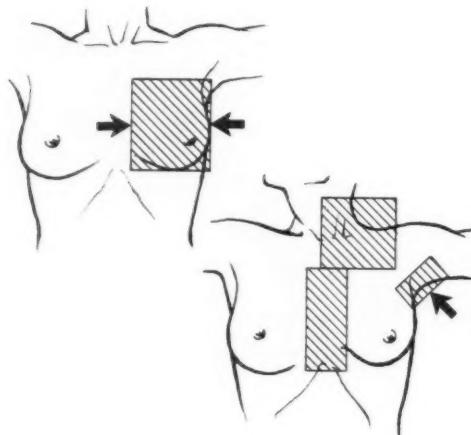


Fig. 2. Technic for inoperable carcinoma of the breast. Two tangential fields for the breast and single fields for the lymph-node areas.

tion. It is worthwhile to achieve effective local palliation with the minimum systemic reaction possible.

MATERIAL

From January 1955 to December 1958, 70 patients with breast cancer in various stages were accepted for electron-beam therapy. Of these 70 patients, 18 were treated for inoperable carcinoma, 38 received treatment for chest-wall recurrences or for lymph-node metastases following surgery, irradiation, or both, and 14 were given postoperative irradiation following radical mastectomy or local excision of the tumor.

Except for the postoperative cases, most patients were in an advanced stage of the disease. Many of them had distant metastases for which ablative or additive hormone therapy was also given before, during, or after radiation treatment.

TECHNICS AND DOSE DISTRIBUTIONS

For the patients with inoperable carcinoma, the breast and its regional lymph-node areas are irradiated through five fields (Fig. 2). Irradiation of the breast itself is given to two tangential fields, measuring 15×9 cm. each, with bolus. The energy used is 22.5 Mev. The dose distribution for a typical set-up is presented

in Figure 3, A. The radiation throughout the breast is quite homogeneous. The vital structures such as lung and heart are relatively spared.

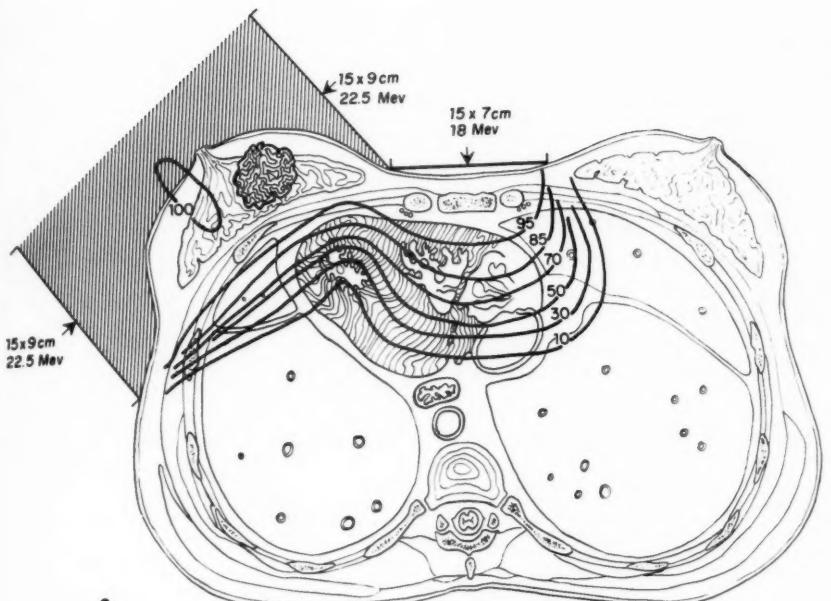
The lymph-node areas are treated with single fields. The internal mammary nodes were originally irradiated at 20 Mev, which was later changed to 18 Mev in order to minimize the amount of radiation delivered to the anterior surface of the heart and lung. The size of the field is 15×7 cm. The isodose contour of the 18 Mev irradiation is presented in Figure 3. The internal mammary nodes are within the 95 per cent line and receive a homogeneous dose. A small segment of the anterior surface of the heart and lung receives some radiation but not a significant amount.

The supraclavicular field is usually irradiated at 22.5 Mev through a 12×12 -cm. field. The isodose distribution for this field is shown in Figure 4. The axillary field usually measures 10×8 cm. or 8×8 cm., depending on the patient's size, and is irradiated at 22.5 Mev. Its isodose distribution is presented in Figure 5.

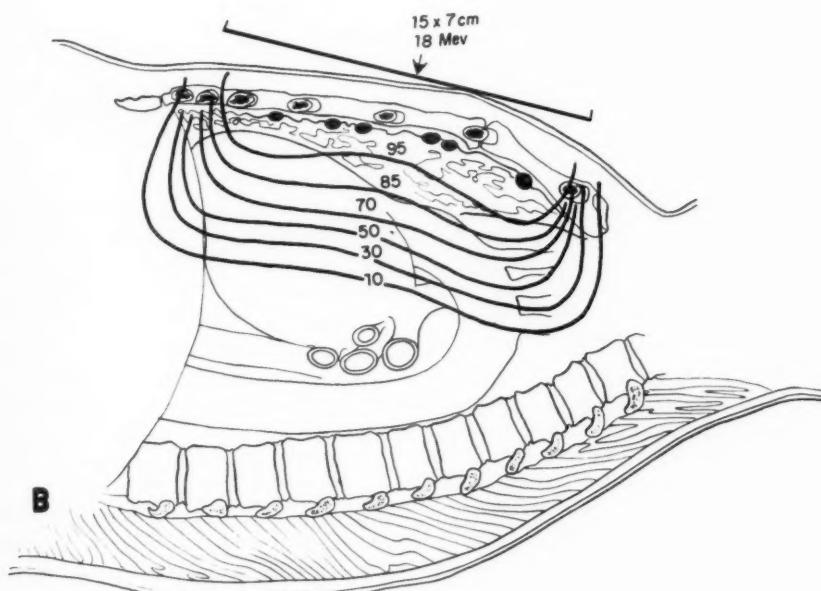
The treatment is planned to deliver 6,000 to 7,000 rads to the breast in six to seven weeks and 4,000 to 5,000 rads to the lymph nodes in four to five weeks.

In the treatment of recurrent or metastatic tumors, single fields are usually employed. The energy is varied from 10.4 to 22.5 Mev, depending on the bulk and location of the tumor. A dose of 4,000 to 5,000 rads is administered in four to five weeks time. Figure 6, A shows a typical treatment for a superficial infiltrative lesion on the chest wall, with 10.4 Mev energy and a 15×15 -cm. field. The isodose curves show that the first 3 cm. of the chest wall receive essentially homogeneous radiation. In the next 2 cm. the dose drops to 10 per cent. Thus the lung does not receive excessive radiation.

For the purpose of comparison, the isodose distributions of a low-voltage (120 kevp) and a high-voltage (250 kevp) x-ray field (Fig. 6, B and C) are presented. It is clear that the low-voltage radiation is not homogeneous. The dose at 1 cm. from



A



B

Fig. 3. A. Isodose distributions of the tangential irradiation to the breast and direct field to the internal mammary nodes. Tangential fields, 15×9 cm. each with bolus, with 22.5 Mev energy; and internal mammary field, 15×7 cm., with 18 Mev energy.
 B. Isodose distribution of the internal mammary field, longitudinal section.

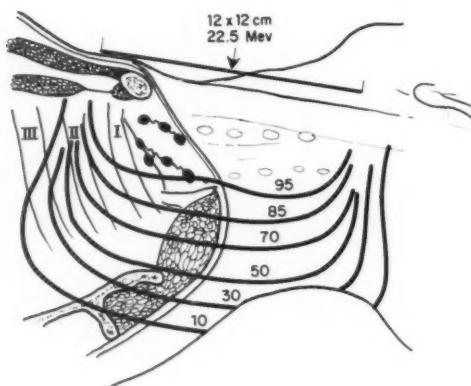


Fig. 4. Isodose distribution of the supraclavicular field, 12×12 cm., with 22.5 Mev energy.

the skin surface is 90 per cent of the skin dose; at 3 cm., 70 per cent; at 5 cm., 50 per cent; and at the depth of 8 cm., 20 per cent. Therefore, the lung receives a considerable amount of radiation. With 250 kevp the dose to the lung is even higher than with the lower voltage. For this reason it is not at all desirable, to use direct fields for 250 kevp irradiation to the chest wall.

Following radical mastectomy irradiation is given through two fields: the internal mammary and the supraclavicular (Fig. 7). The internal mammary field is usually 15×7 cm., centering at 2.5 cm. from the midline on the side of mastectomy; 18 Mev energy is now being used for this treatment. The supraclavicular field is commonly 12×12 cm. and is treated with 22.5 Mev energy. The dose delivered is 4,000 to 5,000 rads in four to five weeks.

All patients treated with the betatron have individual isodose distributions prepared with the co-operation of the Department of Radiologic Physics. Members of this Department are responsible for the day-to-day operation of the betatron and have collaborated in the development of the various techniques described.

RESULTS

In evaluating the objective response to electron-beam therapy, only those patients with measurable disease may be included at this time. As yet nothing can be said

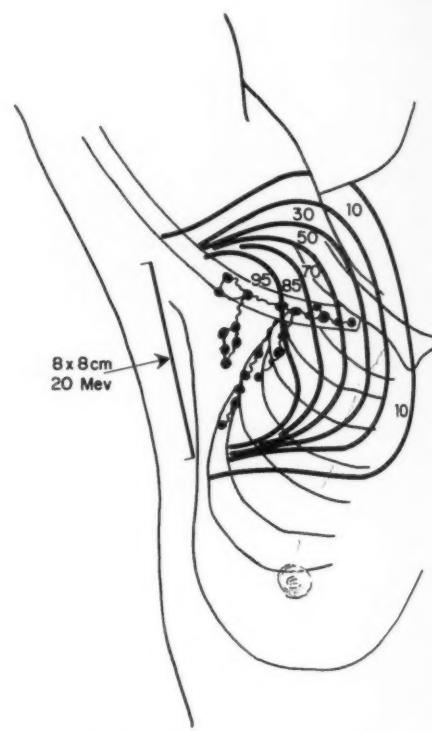


Fig. 5. Isodose distribution of the axillary field, 8×8 cm., with 22.5 Mev energy.

about the patients who received postoperative irradiation. The latter group of patients represent an ideal situation for electron-beam irradiation of the internal mammary and supraclavicular node areas because of the better skin tolerance, homogeneous depth dose, and lack of radiation pneumonitis or fibrosis. However, the number of patients irradiated has been too few and the time too short for a definite evaluation.

Inoperable Carcinoma: Eighteen patients were accepted for the treatment of inoperable carcinoma of the breast. In most of these cases the disease was advanced; in 2 it was inflammatory in nature. In 1 of this group of 18 patients, treatment was considered a failure because the local disease remained uncontrolled and death occurred two months after completion of therapy. Seventeen patients responded well: the tumor was reduced in

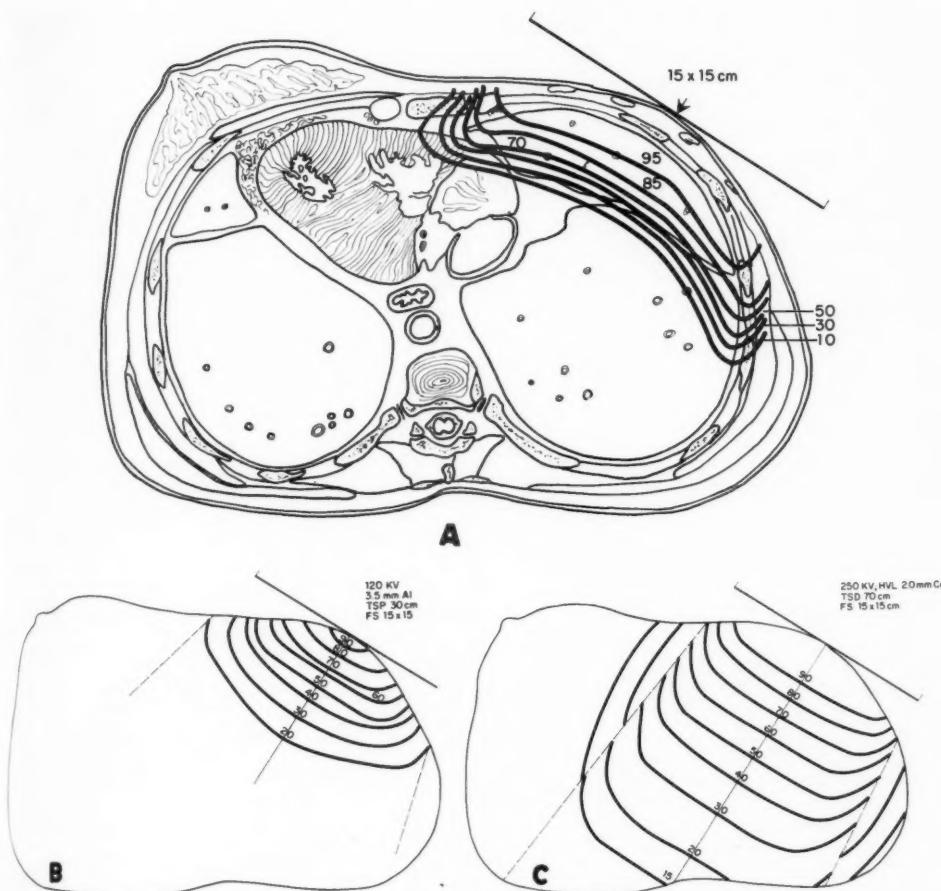


Fig. 6. A. Isodose distribution of a chest-wall treatment by 15×15 cm. field at 10.4 Mev energy, and its comparison with the dose distributions of similar treatment by 120 kVp (B) and 250 kVp x-ray (C).

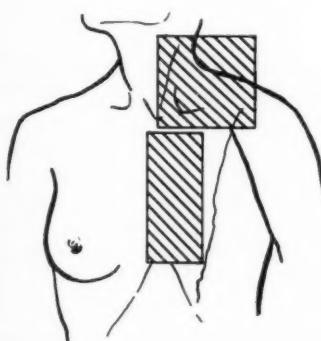


Fig. 7. Technic for postoperative irradiation: 15×7 cm. internal mammary field, with 20 Mev energy, and 12×12 cm. supraclavicular field, with 22.5 Mev energy.

TABLE I: RESULTS OF ELECTRON-BEAM TREATMENT OF INOPERABLE BREAST CARCINOMA

Total number of cases treated	18
Number of cases responding	17
Complete disappearance of tumor	10
Tumor reduced in size but persisting	7
Number of cases failing to respond	1
Mean duration of improvement	11 months
Mean survival	15 months

size in all, and disappeared completely in 10 cases (Table I). The mean duration of regression was eleven months. Most of these patients died of metastases, with the irradiated breast lesion still under control. The mean survival time was fifteen months.

The skin reaction was usually not severe, the majority of the patients having moder-

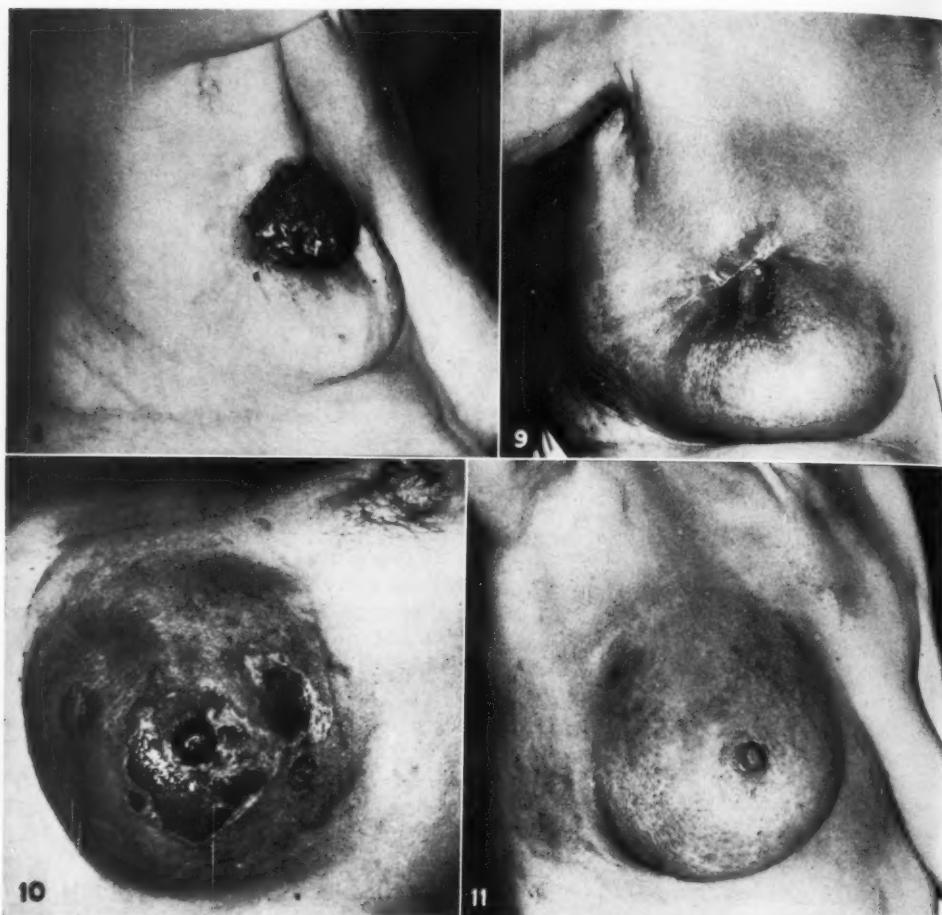


Fig. 8. Case I. Inoperable carcinoma of the right breast before electron-beam treatment.

Fig. 9. Case I. Regression of the tumor and healing of the ulcer following electron-beam treatment.

Fig. 10. Case II. Inflammatory carcinoma of the right breast with ulcerations.

Fig. 11. Case II. Good response to electron-beam irradiation: Clearing of the inflammatory component of the cancer and healing of the ulcerations.

ate erythema, tanning, and dry peeling of the skin. In 1 or 2 patients small areas of moist desquamation developed, with healing within a short time. Two patients in this group who had received a full course of 1-Mev x-ray therapy three and six months prior to the betatron irradiation tolerated the electron-beam treatment with no serious complications.

Lack of systemic reaction was the rule rather than the exception. This may best be illustrated by one of the patients who received simultaneous treatment to both breasts and their regional nodes with no ill

effects. No case of radiation pneumonitis was observed in this group.

Two case histories are reported here for illustration:

CASE I: S. G. was a 45-year-old woman in whom a diagnosis of inoperable carcinoma of the right breast with metastases to the pelvic bones was made in October 1952. Bilateral oophorectomy resulted in clinical improvement lasting until March 1954, when the disease again began to progress. In May 1955, hypophysectomy was performed. The breast tumor remained stationary for about two years before growth recurred, with eventual ulceration (Fig. 8). A course of electron-beam treatment was administered, with a dose of 6,300 rads to the breast

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Fig. 12. Case III. Fungating, ulcerating chest-wall recurrences. Pigmentation and fibrosis in supraclavicular and infraclavicular areas resulting from two previous courses of irradiation.



Fig. 13. Case III. Regression of the tumors following electron-beam treatment. Minimal skin reaction.

in a period of six weeks. Two months later an additional dose of 1,200 rads was delivered for a small residual tumor. Regression continued, and the ulcer healed. Figure 9 shows the appearance four months after completion of treatment. At that time there were scarring and induration but no demonstrable tumor mass. The skin tanning resulting from the betatron irradiation was minimal. The patient died at home six months following completion of therapy. The cause of death was unknown, but was presumed to be generalized metastasis.

CASE II: M. C., a 55-year-old patient, noticed rapid swelling of her right breast in April 1958. When first seen at Memorial Center she had an inflammatory carcinoma with metastases in the right axillary nodes. Hypophysectomy was performed in June 1958, but the disease continued to progress and in July the patient was referred for radiation treatment. At this time the right breast was diffusely involved by inflammatory carcinoma with areas of ulceration (Fig. 10). The right axillary nodes were enlarged. A dose of 6,000 rads was delivered to the breast in six weeks, with gradual clearing of the inflammatory component of the cancer and healing of the ulceration (Fig. 11). The lymph-node areas received 5,300 rads. The patient remained without evidence of recurrence in the treated areas, but the disease spread beyond the radiation portals and death in hepatic coma occurred six months after completion of treatment.

Recurrent Group: Thirty-eight patients with chest-wall recurrence or lymph-node metastases were treated for palliation. Many of the patients in this group had

TABLE II: RESULTS OF ELECTRON-BEAM TREATMENT OF LOCAL RECURRENCE AND LYMPH-NODE METASTASES

Total number of cases treated	38
Number of cases responding	33
Complete disappearance of tumor	24
Tumor reduced in size but persisting	9
Number of cases failing to respond	5
Mean duration of improvement	10 months
Mean survival	12 months

received previous treatment by supervoltage or orthovoltage radiation.

In 33 cases there was favorable response to the electron-beam treatment (Table II): the tumor decreased in size and in 24 patients became nonpalpable. The mean duration of improvement was ten months. Five patients failed to respond. The mean survival time for the entire group was twelve months and at the time of this report 9 were living.

Because of the lower dosage, the problem of radiation reaction was even less in this group of patients than in the inoperable group.

One case illustrative of this group is presented:

CASE III: R. M., a 63-year-old white woman, had a left radical mastectomy at another hospital. Eight years later, in 1954, a local excision followed by radiation treatment was performed for a recurrent mass at the upper end of the mastectomy scar. The radiation factors were unknown. When first seen at

Memorial Center in May of 1955, the patient had enlarged nodes in the left supraclavicular fossa and both axillae. There were many chest-wall nodules, and the liver was enlarged and nodular. Because the left supraclavicular involvement was symptomatic, the patient was given a course of 250-kevp irradiation. In three and a half weeks a dose of 3,600 rads was delivered through two opposing portals. Various hormones, including androgens and estrogens, were then administered and the lesions remained under control until November 1957, when they began to progress. The patient was again referred to Radiation Therapy Department, for consideration of treatment of the fungating and ulcerating tumors on the left chest. Since the largest one, near the clavicle, had received two previous courses of irradiation and the skin showed pigmentation and fibrosis (Fig. 12), electron-beam treatment was elected. The large mass overlying the left clavicle received 4,000 rads in four weeks at 22.5 Mev, and the others received 7,000 rads in seven and a half weeks at 20 Mev. Two and a half months later, there was almost complete regression of all lesions irradiated (Fig. 13). Other lesions subsequently developed and the patient died in October 1959, despite the use of various chemotherapeutic agents. At the time of her death, which was about a year and a half after betatron treatment, the irradiated lesions remained quiescent and there was no evidence of late radiation complication, even in the area where two courses of radiation were administered prior to the betatron therapy.

DISCUSSION

It is too early to evaluate fully the efficacy of high-energy electron-beam radiation in the management of postoperative, inoperable, and recurrent breast cancer. From our present clinical experience, however, we are favorably impressed with this modality. Most of the patients included in this study represented difficult clinical problems, such as recurrence in previously irradiated areas, failures after ablative and additive hormonal treatment, chemotherapeutic failures, and combinations thereof. Because of the advantageous dose distribution and minimal undesirable complications, electron-beam therapy even in this group of patients produced worthwhile palliative results. Fifty out of 56 patients with measurable disease exhibited tumor regression for an average of ten months. More than half of them became locally free of disease. These results, although still preliminary, compare favorably with the

data reported by our group in 1957 (2), at which time supervoltage and orthovoltage techniques were employed. In that study regression of disease was shown in 45 out of 58 patients in the inoperable breast carcinoma group. In the group of 111 patients receiving radiation therapy for local recurrence and lymph-node metastases 80 per cent of the lesions showed regression of measurable disease.

Skin reactions following electron-beam treatment generally have been limited to moderate erythema, pigmentation, and dry desquamation. On rare occasions, there have been small areas of moist desquamation which healed promptly. Little or no intolerance to the irradiation was shown even when multiple fields covering almost the entire thorax were treated. The doses administered were at least equal to those used in supervoltage or conventional techniques and frequently exceeded them. In only a few patients was the question of a systemic reaction raised. Furthermore, there has been no case of radiation pneumonitis or fibrosis in these patients which could be attributed to the electron-beam therapy. In one eighty-year-old patient, however, who was treated too recently for inclusion in this report, radiation pneumonitis developed in the upper anterior segment of the left lung two months following 6,000 rads delivered to the breast in a period of five weeks and 4,000 rads delivered in the regional lymph-node areas in four weeks. The patient's age, the relatively rapid dose rate, and the slightly larger than average supraclavicular field (12 \times 15 cm. instead of 12 \times 12 cm.) may have been the contributing factors to the occurrence of radiation pneumonitis in this case.

SUMMARY

From January 1955 to December 1958, 70 patients with breast carcinoma in various stages were treated by the electron beam of the betatron. The majority of the patients had recurrent chest-wall lesions or lymph-node metastases. High-energy electron-beam therapy seems to

offer distinct advantages in terms of ease of manipulation of dose distributions to fit each individual clinical setting and fewer undesirable complications such as skin and systemic reactions and radiation pneumonitis. The advantages of electron-beam therapy are particularly apparent in the management of recurrent disease within a previously irradiated area. Because of our initial favorable impression this study is being continued.

ACKNOWLEDGMENT: The authors are grateful to the Breast Service of the Department of Surgery, Memorial Hospital, for their continuous co-operation in providing patients for this study. Acknowledg-

ment is also due Mr. Richard Nelson and Dr. J. S. Laughlin of the Department of Physics, Memorial Hospital, for their assistance and co-operation in physical aspects of planning and treatment of the cases here reported. Drs. James J. Nickson and Arvin S. Glicksman contributed many helpful suggestions and discussions.

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SUMARIO IN INTERLINGUA

Therapia a Fasce de Electrones in le Tractamento de Carcinoma del Mamma

Inter januario 1955 e decembre 1958, 70 patientes con carcinoma mammari in varie studios esseva acceptate pro irradiation per fasces de electrones. Le tractamento esseva administrate in 18 casos in que le carcinoma esseva inoperabile; in 38, il habeva recurrentias in le parietes thoracic o metastases de nodos lymphatic post chirurgia o radiation o le duo in combination; in 14, le irradiation esseva post-operatorio post mastectomy radical o excision local del tumor.

Inter le 18 patientes con inoperabile carcinoma, 17 respondeva ben al tractamento per fasces de electrones. In omnes, le tumor esseva reducite in su dimensiones; illo mesmo dispareva completamente in 10. Duo casos illustratori es reportate.

Un favorable responsa al tractamento per fasces de electrones esseva constataate in 33 del 38 casos de recurrentia thoracoparietal o de metastase in nodos lymphatic

post chirurgia o radiation o ambe. Post irradiation le tumor decresceva in su dimensiones, e in 24 del patientes illo esseva non plus palpabile.

Le numero del patientes irradiate post operationes es troppo basse e le intervallo deposit le irradiation es troppo breve pro un evalutation definitive de iste gruppo de casos.

Therapia a fasces de electrones a alte energia pare offerer distinque avantages per le facilitate del manipulation in le distribution del dosage secundo le requirimentos special del paciente e del situation clinic individual e per le reducite importantia del complications adverse, incluse le varie reactiones cutanee e systemic e pneumonitis radiational. Le avantages de iste forma de tractamento es particularmente evidente in casos de recurrentia del morbo intra previamente irradiate areas.

Annular Pancreas¹

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ANNULAR PANCREAS is a condition for which the embryological development has been fairly definitively worked out. There are those, however, who feel that the anomaly does not necessarily represent a developmental error. Whether it is a result of failure of fusion of the ventral and dorsal anlage, however, or is due to simple hypertrophy is of little clinical significance (1).

The importance of the annular pancreas lies in its recognition during life as a possible pathologic entity. By far the majority of cases have been found incidentally, at postmortem examination. There have been enough surgically corrected cases, on the other hand, to prove that the condition is often symptomatic. Why an annular pancreas of considerable extent, with marked narrowing of the caliber of the duodenum, in one individual produces no symptoms, and a less extensive lesion in another gives rise to many symptoms, is neither well understood nor explained.

As a general rule, the deciding factor in the symptomatology is the severity of the duodenal constriction. The lesion is probably the only congenital anomaly of the gastrointestinal tract, which causes symptoms late in life (2). The majority of proved cases have been in patients beyond the age of forty or in the immediate neonatal period with signs or symptoms of high obstruction. We encountered only 2 cases in the literature proved during childhood and, for this reason, our first case is of interest:

CASE I: A 7-year-old male was admitted to the hospital on Oct. 14, 1958, because of intermittent abdominal pain and vomiting of several years duration. The episodes of pain might be several weeks or several months apart; they were cramp-like in character, causing the patient to double up. Invariably with the onset of pain, vomiting occurred. Each episode would last from one to several hours.



Fig. 1. Case I. Obvious narrowing of the proximal descending duodenum.

The past history was noncontributory except for the usual childhood diseases, without complications. Eating habits were not good and weight gain had been poor.

Except for tenderness to deep palpation of the epigastrium, the physical examination was unrevealing.

A diagnosis of mesenteric adenitis was made but, because of the duration of symptoms, a radiographic study was carried out.

An upper gastrointestinal examination with barium showed a distinct narrowing of the entire descending limb of the duodenum; actually, this segment of bowel looked stretched. At its upper limit was a definite shelf, suggesting extrinsic constriction of the lumen on the right side of the loop. There was no gastric dilatation (Figs. 1 and 2). On the basis of the radiographic findings, a diagnosis of annular pancreas was made and an exploratory laparotomy was carried out. A segment of pancreatic tissue over 3 cm. in width was found encircling the duodenum at a point approximately 2.5 cm. from the pylorus. A posterior gastroenterostomy was performed. The patient withstood the procedure well and his recovery was rapid. Nine months following surgery, there had been no recurrence of symptoms.

Our second case of proved annular pancreas is presented because it typifies the lesion in newborn infants.

¹ From Our Lady of Lourdes Memorial Hospital, Inc., 169 Riverside Drive, Binghamton, N. Y. Accepted for publication in February 1960.



Fig. 2. Case I. Predominantly right-sided impression on the duodenum.

CASE II: A female infant was delivered without untoward incident on Aug. 29, 1958. Physical examination immediately postpartum was unrevealing, but at twenty-four hours deepening icterus was noted. Attempts at oral feeding resulted in persistent vomiting, and by the third day only dark meconium had passed from the rectum. Gastric peristalsis was visible. The liver was palpable 2 cm. below the right costal margin. There were no bowel sounds. The urine was normal. Blood studies revealed a hemoglobin of 21 gm., with a hematocrit of 63 volumes per cent. The white count was normal.

Röntgenographic study of the abdomen showed no evidence of air in the small bowel. Only the stomach was air-containing. Examination of the gastrointestinal tract with a water-soluble medium (Gastrograffin, Squibb) was then performed, demonstrating a complete obstruction in the first portion of the duodenum, just beyond the duodenal cap (Figs. 3 and 4).

The following diagnoses were made: duodenal atresia, annular pancreas, reduplication of small bowel.

Surgery on Aug. 30, 1958, revealed marked dilatation of the gallbladder. Pancreatic tissue was found tightly encircling the first portion of the duodenum and also obstructing the common bile duct. Minimal dissection freed the common duct, and prompt emptying of the gallbladder ensued. As further resection of the stenotic segment was not possible, a posterior gastrojejunostomy was performed. The immediate postoperative course was fairly satisfactory, but on the third day a diffuse, exfoliative dermatitis developed. A diagnosis of epidermolysis bullosa was entertained. The infant failed rapidly and died Sept. 2, 1958.

Our third case was felt preoperatively to be the most typical in so far as the radiographic findings were concerned. The differential diagnosis of annular pancreas includes: duodenal bands, duodenal atresia, and retroperitoneal masses such as carcinoma of the pancreas, lymphoma, and



Figs. 3 and 4. Case II. Distended duodenal bulb and stomach with lack of air or contrast material distally.



Fig. 5. Case III. Constriction of duodenum by enlarged nodes, mistakenly diagnosed annular pancreas.

enlarged lymph nodes. Lymph node enlargement is considered extremely rare, but this case proved the exception.

CASE III: A 2-year-old white boy was admitted on Oct. 28, 1959, with intermittent vomiting of over one year duration. At the age of eleven months, a gastrointestinal study done elsewhere was reported as normal. The child's eating habits were poor and he was pale and underweight. The initial blood studies disclosed an anemia with hemoglobin of 9.5 gm. and a hematocrit of 33 per cent. Stool studies at first suggested pancreatic insufficiency but a repeat trypsin test was normal.

On gastrointestinal examination, a persistent, wide, ring-like constriction was encountered in the second portion of the duodenum (Fig. 5); findings in two weeks were identical. The preoperative diagnosis was annular pancreas.

At exploration, no annular pancreas was found. All of the intra-abdominal lymph nodes were enlarged, of firm consistency, pale gray in color, discrete, with no evidence of matting together. Microscopic examination revealed hyperplastic changes and a diagnosis of chronic lymphadenitis was made. It was felt by the surgeons that enough enlarged nodes were present about the duodenum to cause pressure and the resultant narrowing demonstrated preoperatively.

DISCUSSION

The roentgen findings associated with annular pancreas have been adequately

reported elsewhere, particularly by Hope and Gibbons (8). Symptomatology depends upon the degree of obstruction of the duodenum. In newborn infants, vomiting is noted early and becomes increasingly severe. The vomitus may or may not contain bile, depending upon the relationship of the constricted segment to the common duct. Jaundice is not infrequently seen but is not typical since, as a general rule, the common duct is not involved. The anomaly appears to be more common in males, though not markedly so.

In children, there occur intermittent bouts of vomiting and upper abdominal pain, due undoubtedly to transient obstruction. These symptoms may well be the result of edema from associated pancreatitis. Adults exhibit similar symptomatology; two clinical types are recognized: one with poorly defined epigastric distress or indigestion resembling peptic ulcer symptoms and the other with intermittent obstructive manifestations.

Finally, in the large number of cases discovered incidentally postmortem, pathologic section often reveals evidence of chronic pancreatitis. In all probability, many of these so-called asymptomatic patients were actually symptomatic, but the symptoms were either discounted or of low severity (3). Very often, there are other, associated anomalies. These include intestinal malrotation, aberrant pancreas, duodenal atresia, and duodenal stenosis (5). Coexistent disease may include peptic ulcer, gastritis, and pancreatitis (3, 5).

SUMMARY

Two cases of surgically proved annular pancreas and a third case simulating annular pancreas are presented.

The increasing frequency of reports of this anomaly indicates the importance of its consideration in the differential diagnosis of high intestinal obstruction or duodenal abnormality.

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SUMMARIO IN INTERLINGUA

Pancreas Anular

Pancreas anular es incontrate le plus communmente durante le periodo neonatal e al etate de plus que quaranta annos. Le symptomas in neonatos es le symptomas de un alte obstruction causate per constriction duodenal. Le condition es incontrate raramente in juveniles plus avançiate, sed un tal caso es reportate per le autores. Intermittente episodios de vomito e dolores supero-abdominal es le major manifestationes clinic a iste etate. In adultos, le symptomatologia es simile. In un gruppo il ha un mal definite angor epigastrique o indigestion simulante ulcere

peptic; in le altere, intermittente symptomas obstructive.

Es reportate duo casos de pancreas anular insimul con un tertie in que le constataciones esseva considerate como typic de pancreas anular ante le operation sed in que il se tractava de allargate nodos lymphatic que exercava un pression super le duodeno.

Le crescente frequentia de reportos de iste anormalitate indica le importantia de prender lo in consideration in le diagnose differential de obstruction alti-intestinal o de anormalitate duodenal.



Histiocytosis X

Report of a Case of Hand-Schüller-Christian Disease¹

CAPT. ALLAN E. GREEN, JR., USAF, MC, and ROBERT A. FLAHERTY, M.D.²

HISTIOCYTOSIS X, also known as reticuloendotheliosis, has received considerable attention in the literature in recent years (2, 3, 5, 6, 7, 9). The present case of Hand-Schüller-Christian disease, which is one of the entities included under the more general designation, is reported because it demonstrates survival following extensive involvement and displays several unusual clinical and radiographic findings. A new roentgen sign of prognostic significance is described.

CASE REPORT

C. D., a white female, was born in May 1951. Delivery was full-term, normal, and spontaneous.

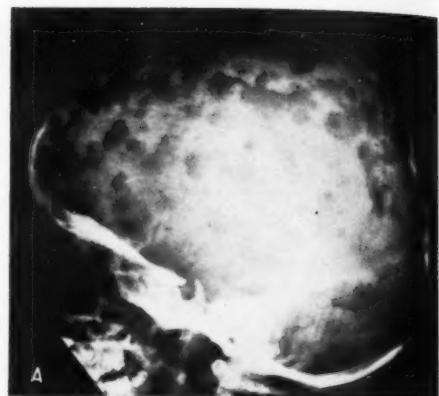


Fig. 1A. Skull in 1953, showing multiple osteolytic lesions, "maplike or geographical" appearance.

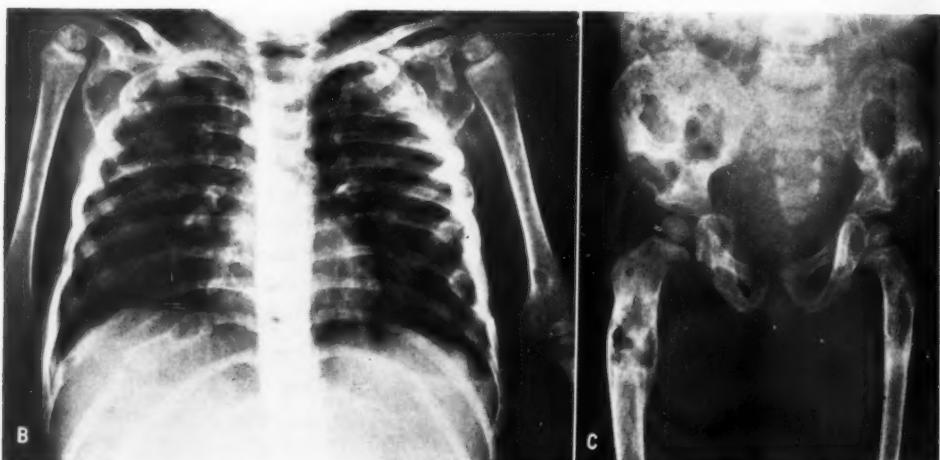


Fig. 1B. Chest, 1953, showing osteolytic defects of ribs, clavicles, scapulae, and humeri. The lungs are clear.

Fig. 1C. Pelvis, 1953. Osteolytic lesions of ilia, ischia, and femora. Note pathologic fractures of ilia and right femur.

Birth weight was 8 pounds. The first year and a half of life were uneventful, and growth and development proceeded at a normal rate. There was a history of varicella at the age of twelve months.

In November 1952, the child became irritable; she refused solid foods, and polydipsia and polyuria

developed. Symptoms became progressively more severe, and in February 1953, she was hospitalized because of dehydration, weight loss, and fever. Her head was enlarged and deformed. Skull films revealed multiple osteolytic defects (Fig. 1, A), and additional roentgenograms disclosed multiple oste-

¹ From the Department of Radiology, United States Air Force Hospital, Lackland Military Training Center (ATC), Lackland Air Force Base, Texas. Accepted for publication in December 1959.

This paper represents the personal point of view of the authors and is not to be construed as official Air Force policy.

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lytic skeletal lesions (Figs. 1, B and C). The lungs were normal. Laboratory findings at this time were hemoglobin 8.3 gm. per cent; leukocyte count 10,000; total lipids, 743 mg. per cent; total cholesterol, 246 mg. per cent; cholesterol esters, 78 per cent.

Microscopic biopsy sections from the occipital area of the skull disclosed osseous and connective-tissue infiltration by eosinophils, lymphocytes, and histiocytes. The histiocytes were described as large cells having pale-staining, basophilic nuclei and a foamy cytoplasm. The histologic, roentgenographic, and clinical findings were consistent with Hand-Schüller-Christian disease.

Therapy at this time consisted of intramuscular aqueous pitressin and roentgen irradiation directed to the skull through two lateral 10 \times 10-cm. portals. Each area received a tumor dose of 450 r, fractionated.

The patient's status changed little over the next eighteen months. The diabetes insipidus was controlled with pitressin and further roentgen therapy was given on numerous occasions between May 1953 and August 1955, to the skull, thorax, scapulae, pelvis, femora, tibiae, humeri, and right radius. Total dosage to any one area varied from 200 to 700 r as measured in air; half-value layer for all treatments was 1.2 mm. Cu.

Pathologic fractures of the left ilium and right femur were sustained in December 1953. These healed without complication after immobilization in a cast.

In August 1954, at the age of three and a half years, the patient was hospitalized because of severe anemia, the hemoglobin being 4.4 gm. per cent and the red blood count 1,530,000. At this time the bone lesions were extensive. Roentgenograms of the chest disclosed bilateral pulmonary infiltration (Fig. 2). Moderate exophthalmos was present. Under treatment with blood transfusions, oral iron, and roentgen irradiation (skeletal areas, thorax,



Fig. 2. Chest, 1954. Pneumonitis first observed. Child was critically ill, with severe anemia. Extensive skeletal lesions are still present.

skull), the hematologic status stabilized at a normal level in approximately two months.

A chest roentgenogram obtained in May 1956 showed extensive pulmonary infiltration and fibrosis (Fig. 3).

Since August 1955, the patient has been closely observed, and has required no therapy other than pitressin and oral penicillin. She has moderate exophthalmos and slight enlargement of the skull, but is alert, active, and happy. The blood picture has remained stable; hemoglobin in November 1958 was 13.0 gm. per cent, red cells 4,400,000. Roentgenograms show that the osteolytic lesions have gradually filled in and that new bone formed at the epiphyses is normal. The infiltration in the lungs, which was most pronounced in May 1956, has gradually cleared, leaving only minimal residual fibrosis.



Fig. 3. Chest, 1956. Extensive interstitial infiltration and fibrosis of the lungs. The skeletal lesions are healing.



Fig. 4. Chest, 1958. Improvement in pulmonary fibrosis. Skeletal lesions have almost completely disappeared.



Fig. 5A. Pelvis, January 1956. Osteolytic lesions are extensive. Note the normal appearing new bone at the iliac crests and femoral neck.

Fig. 5B. Knees, late 1955, at time of clinical remission. Skeletal lesions are evident. New bone in the distal femora and proximal tibiae.

Fig. 6A. Pelvis, 1958. Skeletal lesions improved and healing by fibrosis. Additional new bone at iliac crests.

Fig. 6B. Knees, 1958. Healing skeletal lesion. Note demarcation of abnormal and normal bone. Normal new bone appears radiolucent.

COMMENT

This case presents the classic triad of Hand-Schüller-Christian disease—skeletal lesions, diabetes insipidus, and exophthalmos. Additional findings include pul-

monary infiltration and severe anemia. The patient has been closely followed for six years. She has had roentgen therapy for the bone and lung lesions, and pitressin controls the diabetes insipidus.

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There are three aspects of this case that are of clinical and roentgenographic significance, namely, the existence of a severe anemia at one stage of the disease, the reversal of the pulmonary findings, and the skeletal appearance after remission.

Avery *et al.* state that the presence of anemia in Hand-Schüller-Christian disease is quite uncommon and is usually accompanied by a grave prognosis (1). During the most severe phase of the disease, a marked anemia developed. This responded to therapy and has not recurred in four years. Its underlying cause has not been explained, except possibly on the basis of replacement of the hematopoietic tissue by histiocytes. In this case the anemia was a reversible process.

The reversibility of the pulmonary manifestations after spontaneous remission of the disease is discussed by several authors. Hodgson *et al.* state that the lung lesions may disappear completely or irregular linear strands of fibrosis may remain (4). Ponseti reports 2 cases with complete disappearance of the pulmonary changes after remission (8). Avery reports a series of 10 cases in which the lung infiltrations resolved completely; in 1 of these the condition had persisted ten years before full resolution occurred (1). Evidence of interstitial fibrosis may remain for long periods and in some cases result in *cor pulmonale*. Our patient exhibited quite marked improvement in the pulmonary findings in a relatively short time (Fig. 4).

The most significant aspect of this case is the appearance of the serial roentgenograms of the skeletal system. At the height of the disease process, there was extensive bone involvement (Fig. 1). As new bone was formed at the epiphyses, it quickly became involved in the osteolytic process. Spontaneous remission and general clinical improvement occurred late in 1955. Skeletal roentgenograms in 1956 showed new bone formation that did not contain osteolytic defects at the epiphyses (especially the distal femora, proximal tibiae and iliac crests). There was a clear



Fig. 7. Roentgenogram of skull, 1958. Marked healing since onset of disease.

demarcation between the previously affected abnormal bone and the new normal bone (Fig. 5). Serial films obtained over the next three years showed continued formation of normal bone at the epiphyses (Fig. 6). The previous osteolytic lesions improved, apparently healing by fibrosis. The appearance of new bone without destructive process was seen on the roentgenograms soon after the clinical remission. We can find no mention in the literature of similar skeletal findings. In retrospect, it is apparent that the normal new bone was an indication of the quiescence of the disease process. We submit that it may be a useful prognostic sign for evaluating similar cases.

SUMMARY

A case of Hand-Schüller-Christian disease is reported. The patient had extensive somatic involvement with remission following supportive care and x-ray therapy. Particular attention is directed toward the reversal of pulmonary manifestations, the presence of severe anemia, and the skeletal appearance before and after spontaneous remission of the disease process.

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SUMMARIO IN INTERLINGUA

Histiocytosis X: Reporto de Un Caso de Morbo de Hand-Schüller-Christian

Sub le designation general de histiocytosis X un caso de morbo de Hand-Schüller-Christian es reportate. Le paciente, primo vidite al etate de dece-octo menses, presentava le triade classic de syndrome de Hand-Schüller-Christian, i.e.: lesiones skeletal, diabete insipide, e exophthalmia. Plus tarde, anemia de forma sever se disveloppava, e un extense infiltration e fibrosis pulmonar occurreva.

Al tempore del presente reporto, le paciente se trova sub observation deposit sex annos. Durante iste periodo de tem-

pore ille recipeva therapia a radios X pro le lesiones ossee e pulmonar. Le diabete insipide esseva stabilisate per medio de un tractamento a pitressina. Le anemia respondeva al tractamento. Il occurreva un remission in le alteraciones ossee e un reversion del manifestaciones pulmonar. Pelliculas in serie demonstrava le continue formation de osso normal al epiphyses. Es sugerite que isto va possibilmente esser utile como signo prognostic in le evaluation de simile casos.



Evaluation of the Cervical Spine in Whiplash Injuries¹

HERBERT R. ZATZKIN, M.D., and FRANK W. KVETON, M.D.

IN CONTRADISTINCTION to the crippling and fatal injuries associated with speeding vehicles on our Nation's highways, there is being seen with increasing frequency a more subtle though at times distressing injury in accidents involving vehicles traveling at slower speeds on our urban and suburban roads. These "whiplash injuries" have received considerable attention in the literature, with discussions of their mechanisms (4, 6, 7), physiology (9), treatment (8, 9), follow-up, and medico-legal implications (2, 3). One hundred and seven cases have been reviewed.

In our experience, the patient, in most instances the driver of an automobile, reports that he was slowing down or waiting for a traffic light to change when another vehicle struck his car from the rear. He will usually state that his head snapped backward forcibly and was then jerked forward with equal violence. Seletz (9) has described the injury as due to an acute flexion or a severe hyperextension of the cervical spine. Nagle (7) believes that it can occur as a result of striking any object "head on" as well as of being struck from behind.

Personal communication with several radiologists indicates a great divergence of views concerning the number of roentgenograms and the projections to be used, as well as roentgen criteria employed, in arriving at a diagnosis of whiplash injury. The attempt made at Meadowbrook Hospital (Hempstead, New York) to standardize roentgen exposures in such cases, and to assess the findings which will contribute to a diagnosis of whiplash injury, forms the basis of this paper.

METHOD

Patients considered as having been subjected to the type of trauma described above were examined radiographically by

a "whiplash series," which included the following projections:

1. An anteroposterior view of the cervical spine (supine, Bucky technic at 40 in.) (Fig. 6, A)
2. An open-mouth view of the odontoid (as above) (Fig. 7)
3. A lateral view of the cervical spine, with chin relaxed (at 72 in., standing) (Fig. 2, B)
4. A lateral view in maximum flexion (72 in., standing) (Fig. 2, A)
5. A lateral view in maximum extension (72 in., standing) (Fig. 2, C)
6. A 45° right oblique view (72 in., standing) (Fig. 5, A)
7. A 45° left oblique view (as above)

Fifty adult patients, 25 men and 25 women, all of whom had previously sustained a whiplash injury, were compared to 35 normal adults (25 men and 10 women). The paucity of volunteers in this latter group is a reflection of current fear of ionizing radiations. In the normal group, no history of trauma or symptomatology referable to the cervical spine could be elicited. In all instances a low-dose roentgen technic was employed; fast screens, high-speed films, use of cones, filters, and gonadal shielding kept the total roentgen exposure low. It was estimated that an entire whiplash series delivered no more than 225 milliroentgens to the skin of the neck.

ROENTGEN EVALUATION

Each roentgenogram was initially scrutinized for evidence of fracture or dislocation. None of the patients in this series suffered such injury. The neutral lateral view, the anteroposterior projection, and the odontoid view were used for this preliminary screening. The films were then studied under the following headings:

¹ From Meadowbrook Hospital, Hempstead, N. Y. Accepted for publication in February 1960.

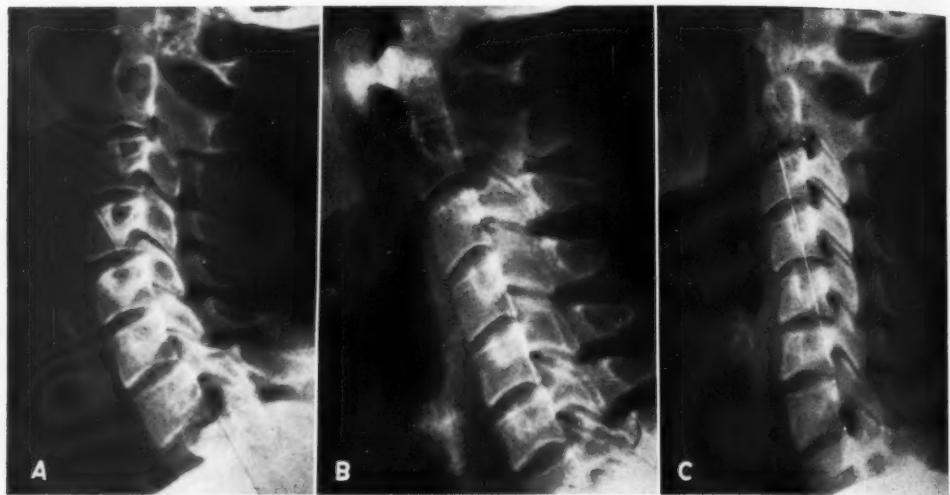


Fig. 1. Lateral roentgenograms of the cervical spine made in the neutral position in three normal persons who denied a previous history of trauma to the neck.
 A. Normal cervical lordosis. Note slight overriding of superior articular process of C5.
 B. Marked straightening of the cervical spine.
 C. Segmental straightening of upper cervical spine, associated with reversal of the curve at C5-6. Note posterior wedging of the C6-7 intervertebral disk space.

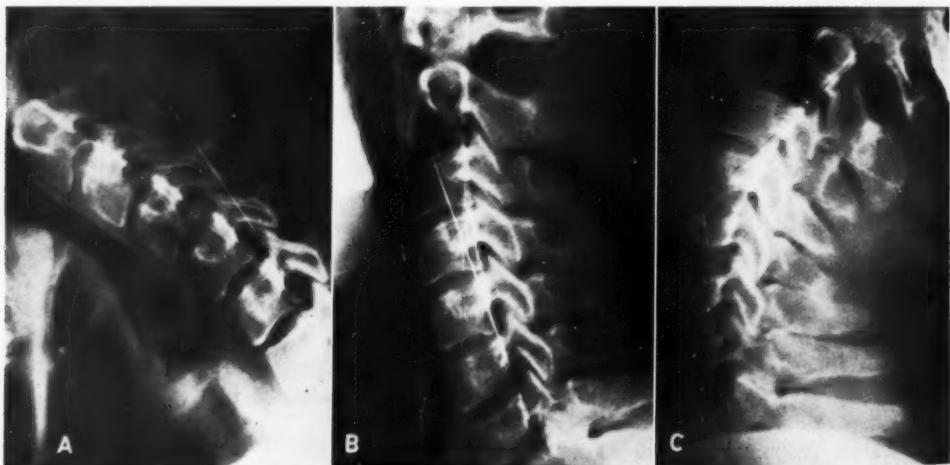


Fig. 2. Demonstration of the range of motion of a normal cervical spine. A. Normal flexion. B. Neutral lateral. C. Normal extension.

I. The Neutral Curve: This was evaluated from the lateral view with the chin relaxed at 90°. The presence of lordosis, straightening, or reversal of the curve was recorded (Fig. 1).

II. Ability to Flex the Cervical Spine: This function was evaluated from the

lateral projection taken in maximum flexion. An attempt was made to assess the degree of limitation, with a description of the findings as normal, slightly limited, or markedly limited (Fig. 3).

III. Ability to Extend the Cervical Spine: This was evaluated from the lateral view

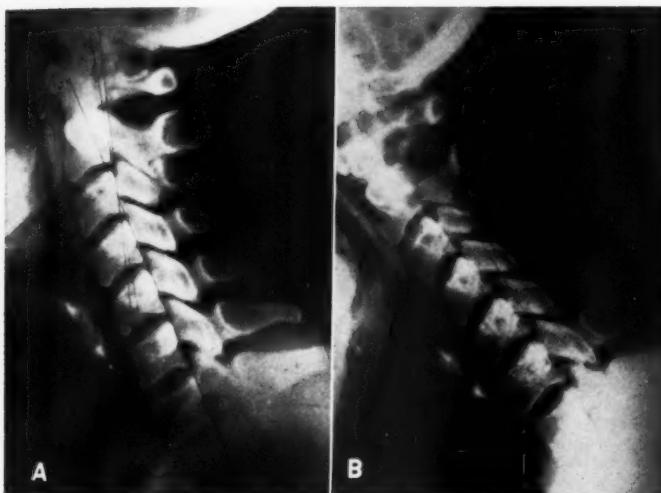


Fig. 3. This patient was involved in an automobile accident in which her car was hit from the rear. She suffered gradual onset of neck pain.
 A. Neutral lateral view, showing loss of lordosis and segmental straightening.
 B. Marked limitation of flexion. Note position of mandibular ramus on each film.

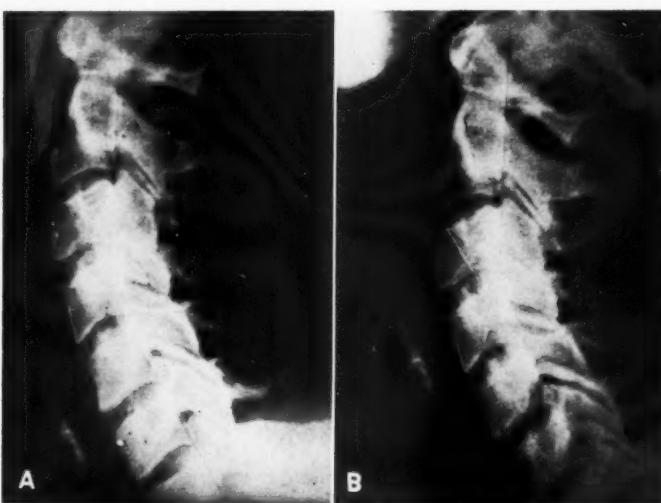


Fig. 4. Case from normal group with no history of neck trauma.
 A. The neutral lateral projection shows an almost normal lordotic curve with slight segmental straightening below C4. Note marked degree of overriding of superior articular process of C4.
 B. Extension is markedly limited. Note position of mandible.

taken in maximum extension and similarly recorded as normal, slightly limited, or markedly limited (Fig. 4).

IV. Overriding of Articular Processes: Upon the assumption that under normal

conditions the superior articular processes of each cervical segment are projected behind the posterior aspects of the lower border of the cervical body above it (5), each neutral lateral roentgenogram was

TABLE I: FINDINGS IN 50 PATIENTS WITH WHIPLASH INJURIES (GROUP A) AND 35 NORMAL SUBJECTS (GROUP B)

	Whiplash Group A (%)	Normal Group B (%)	Relative Incidence A:B
I. The neutral curve (Fig. 1)			
Slight straightening	16	14	1:1
Marked straightening	16	3	5.3:1.0
Segmental straightening	24	49	1:2
Reversal of curve	42	14	3:1
II. Ability to flex cervical spine (Fig. 3)			
Slightly limited	36	31	1.1:1.0
Markedly limited	60	6	10:1.0
III. Ability to extend cervical spine (Fig. 4)			
Slightly limited	50	26	1.9:1.0
Markedly limited	30	14	2.1:1.0
IV. Overriding of articular processes			
Minimal and marked degree	86	80	1.1:1.0
V. Status of intervertebral disk spaces			
Posterior wedging	20	9	2.2:1.0
Narrowing	18	9	2:1.0
VI. Status of intervertebral foramina (Fig. 5)			
Encroachment on at least one foramen	98	54	1.8:1.0
VII. Scoliosis (Fig. 6)			
Present	46	9	5.1:1.0

scrutinized for overriding of the articular processes. Projection of the articular process over the posterior aspect of the body above it was described as a slight degree of overriding (Fig. 1, A). Where the superior articular process came to lie beneath the transverse process of the segment above, the condition was described as showing a marked degree of overriding (Fig. 4, A).

V. *Status of Intervertebral Disk Spaces:* This was assessed from the neutral lateral projection, and the presence or absence of associated hypertrophic arthritis was recorded. The spaces themselves were evaluated as to vertical height and presence or absence of wedging (Fig. 1, C).

VI. *Status of the Intervertebral Foramina:* This was evaluated for each side from the right and left oblique projections. Encroachment upon the normal contour of the foramen was recorded (Fig. 5).

VII. *Presence or Absence of Scoliosis:* Variation from the normal vertical alignment of the cervical segments was recorded as scoliosis (Fig. 6, B). Determinations were made from the anteroposterior projection.

FINDINGS AND DISCUSSION

The findings in the 50 patients comprising the whiplash group, which we have

called Group A, expressed as a percentage of the total number of cases, are given in Table I. The table includes also the findings in the normal subjects (Group B) and the relative frequency (A:B) in the two groups.

I. It is apparent that the presence of a slight degree of straightening of the usual lordotic cervical curve cannot be used as a criterion for the diagnosis of a whiplash injury. Almost complete obliteration of the curve and its reversal occurred, however, 5.3 and 3.0 times as frequently, respectively, as in the normal group, and thus take on significance. It is of interest that segmental straightening was observed with greater frequency in the normal group.

II. Slight limitation of flexion of the neck would also appear not to be a significant finding upon which to base a diagnosis of a whiplash injury, since this occurred on a 1:1 basis of relative frequency. Marked limitation of ability to flex the cervical spine, however, was the most consistent finding and occurred in a 10:1 ratio.

III. Slight and marked limitation in ability to extend the cervical spine occurred twice as frequently in the abnormal as in the normal group. This is believed to be a significant finding.

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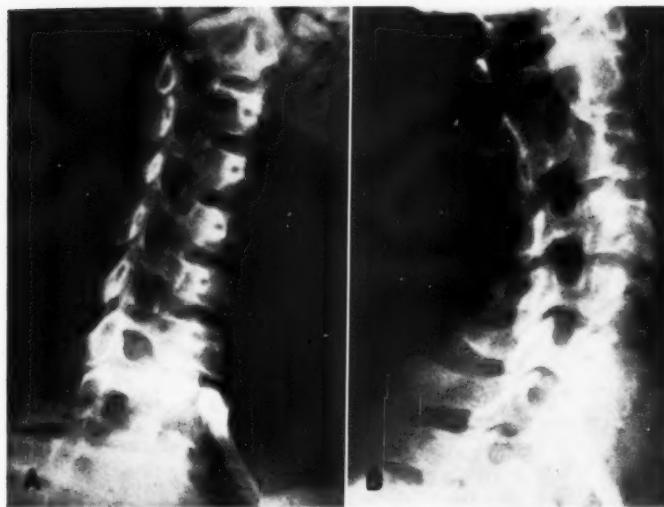


Fig. 5. Oblique projections of cervical spine in two patients.

A. In this instance, from the normal group, the intervertebral foramina are of equal size and outline.
 B. This patient was in an automobile accident and suffered a neck injury. Note encroachment on the intervertebral foramina between C4-5 and C5-6.

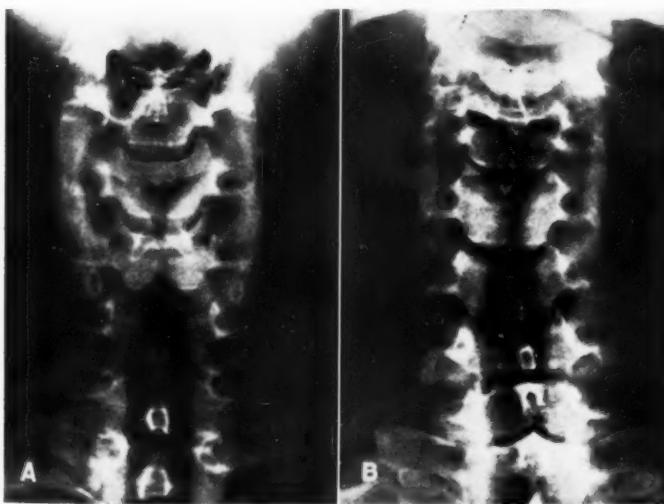


Fig. 6. Anteroposterior projections of the cervical spine in two normal subjects. A. Normal appearance. B. Slight scoliosis.

IV. The nearly equal frequency of overriding of the articular processes was a surprising finding and would indicate that its presence is of no significance in diagnosis of a whiplash injury.

V. It is to be noted that observations of the intervertebral disk spaces are

exclusive of associated hypertrophic arthritis. Wedging and narrowing seem to be of similar import, each appearing twice as frequently in the abnormal group.

VI. Encroachment upon the normal contour of the intervertebral foramina



Fig. 7. Normal open-mouth view to show odontoid and lateral masses of C1.

would appear to have some diagnostic value.

VII. Scoliosis is of considerable significance as evidenced by its occurring 5 times more frequently in the abnormal group.

Closer analysis of some of the findings indicates some interesting interrelationships. For example, in the presence of segmental straightening, 81 per cent of patients in the normal group were still able to flex the cervical spine normally. On the other hand, none of the patients with segmental straightening after neck trauma could flex the neck normally.

CONCLUSIONS

Fractures and dislocations of the cervical spine are relatively infrequent after whiplash injuries. On the contrary, there are quite commonly demonstrated a multiplicity of roentgen findings which are secondary to soft-tissue injury. Some of

the latter findings occur with greater frequency than others, while some are observed just as frequently in a group of patients who were never subjected to injury of the whiplash type.

Criteria upon which a diagnosis of a whiplash injury can be based, listed in order of decreasing importance, are:

Ten times as frequent as in the normal spine:

- (a) Marked decrease in ability to flex the cervical spine.

Five times as frequent as in the normal spine:

- (a) Marked straightening of the neutral curve.

(b) Scoliosis of the cervical spine.

Three times as frequent as in the normal spine:

- (a) Reversal of the cervical curve.

Twice as frequent as in the normal spine:

- (a) Slight to marked inability to extend the cervical spine.

(b) Wedging and narrowing of one or more intervertebral disks.

- (c) Encroachment on one or more intervertebral foramina.

Criteria which cannot be used for a diagnosis of whiplash injury are: slight straightening of the cervical spine in neutral position; segmental straightening in neutral position; slight limitation of flexion of cervical spine; overriding of superior articular facets.

SUMMARY

1. Roentgenograms of the cervical spine in 50 patients with whiplash injury and in 35 normal persons have been reviewed.

2. The minimal number of roentgenograms and the projections required to study such patients are described.

3. Criteria for the diagnosis of a whiplash injury are suggested.

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SUMARIO IN INTERLINGUA

Evaluation del Spina Cervical in Traumatismo "Whiplash"

Le epitheto "whiplash" se usa in anglese pro characterisar le traumatismo accidental in que le victima ha le sensation que su collo suffre le motion violente de un cordon de flagello in action.

Le constataciones roentgenologic in 50 personas qui habeva previemente suffrite un traumatismo whiplash esseva comparate con illos in 35 subjectos normal sin antecedente de traumatismo e sin symptomas referibile al spina cervical. Pro iste objectivo, septe roentgenogrammas esseva obtenite routinariamente: Anteroposterior a 40 pollices; vista del processo odontoide, a buca aperte; lateral, con mento relaxate; lateral in flexion e in extension; dextero-oblique e sinistro-oblique.

Super le base de iste exposiciones, le

seiguiente criterios pro le diagnose de traumatismo whiplash es listate in le ordine de un decrescente importantia: (1) Marcate reduction del capacitate de flecter le spina cervical; (2) marcate rectilineation del curva neutre e del scoliose; (3) reversion del curva cervical; (4) leve o marcate grados de incapacitate de extender le spina cervical, cuneation e constriction de un o plures del discos intervertebral, e intection partial de un o plures del foramina intervertebral. Criterios que non pote esser usate in le diagnose es leve grados de rectilineation del spina cervical in position neutre, rectilineation segmental in position neutre, leve grados de restriction del flexion, e transpassage de facietas articular superior.



Limitation of Hypertrophic Spur

Formation by the Costovertebral Articulations¹

MALCOLM D. JONES, M.D.²

HYPERTROPHIC spurring of the thoracic vertebral margins is so frequently encountered in asymptomatic individuals that its presence is accepted as normal in persons over thirty years of age. The occasional patient with radicular pain in the thoracic area who concomitantly shows spur formation is more difficult to evaluate. If it is assumed that radicular pain at any level may be due to spur formation on the vertebral body, it must be postulated that the spur lies in apposition to the nerve root or its surrounding soft tissues and thereby produces pressure. In viewing roentgenograms of the thoracic spine with extensive spur formation, the radiologist may not realize the anatomic relation of the rib head, intervertebral disk, and neural foramen, and may possibly conclude that a large spur encroaching on the neural foramen is the cause of symptoms.

In *Gray's Anatomy* the costovertebral articulation is described as a double joint with the rib head containing two facets for articulation with the depressions on the bodies of two adjacent thoracic vertebrae. These structures are held in apposition by the radial and interarticular ligaments, the latter merging with the annulus fibrosus of the intervertebral disk. The interarticular ligament attaches to the crest between the facets of the rib and divides the joint space into its upper and lower portions (Fig. 1). The position of the corresponding facets on the vertebral bodies, laterally and far posteriorly, makes radiographic demonstration difficult. Posterior extension of lateral hypertrophic spurring is likewise hard to assess.

METHOD AND OBSERVATION

To test the assumption that the costovertebral articulation prevents spur formation in the posterolateral aspect of the vertebra, the right half of a thoracic spine specimen was sectioned serially from the lower half of the first thoracic vertebra through the intervertebral disk between the tenth and eleventh vertebrae (Fig. 2). Radiographs were made of the serial sections in a cephalad-caudad direction. Sections through the intervertebral foramen, the costovertebral joint, and intervertebral disk show that at no time is the intervertebral disk in direct apposition with the neural foramina. The anatomic relation from the level of the intervertebral disk below the first thoracic vertebra to that below the ninth thoracic vertebra is such that at these levels the rib heads articulate with adjoining vertebrae.

Figure 3 shows the anterior level reached by the head of the second rib. Lateral spurring arising anterolaterally and terminating at the level of the rib head is seen in Figures 4 and 5, with bony deposition in the lateral aspect of the intervertebral disk in Figure 5. In Figure 6, showing the intervertebral disk between the ninth and tenth thoracic vertebrae, and supra- and subjacent vertebral bodies, a large spur extends back to the level of the rib head, actually extending over the head of the rib but limited from further posterior extension by the rib.

In the intact specimen, spurs ended at the anterior limits of the radial ligaments around the rib head, except at the level of the eleventh and twelfth thoracic vertebrae, where bony fringes reached the posterolateral aspect of the vertebral bodies. At these levels the rib articulates directly with one vertebral body and does not lie in apposition with the intervertebral disk.

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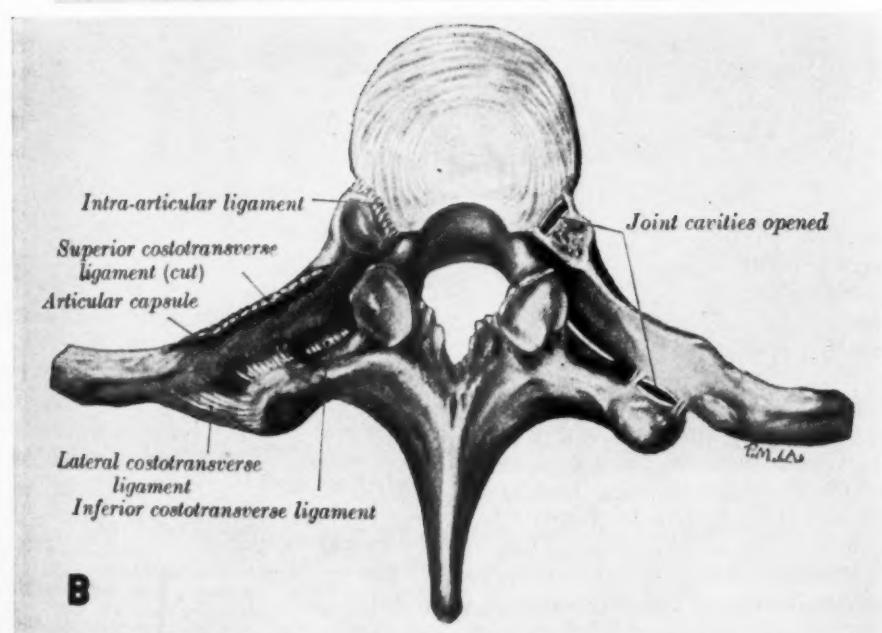
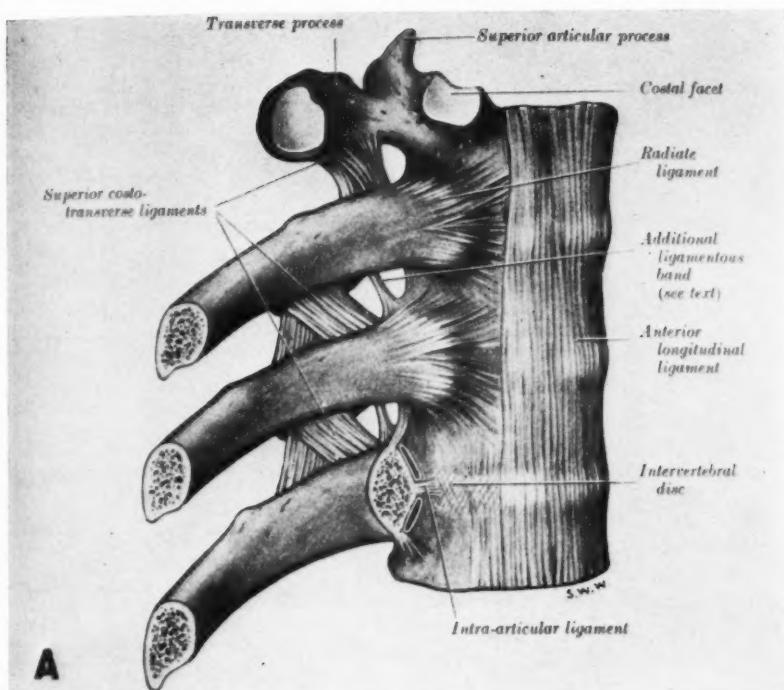


Fig. 1. Ligaments of the costovertebral articulations. A. Anterolateral projection. B. Viewed from above. (Courtesy, Johnston, T. B., and Whillis, J., editors: Gray's Anatomy. London, Longmans, Green & Co., Ltd. 31st ed. 1954.)

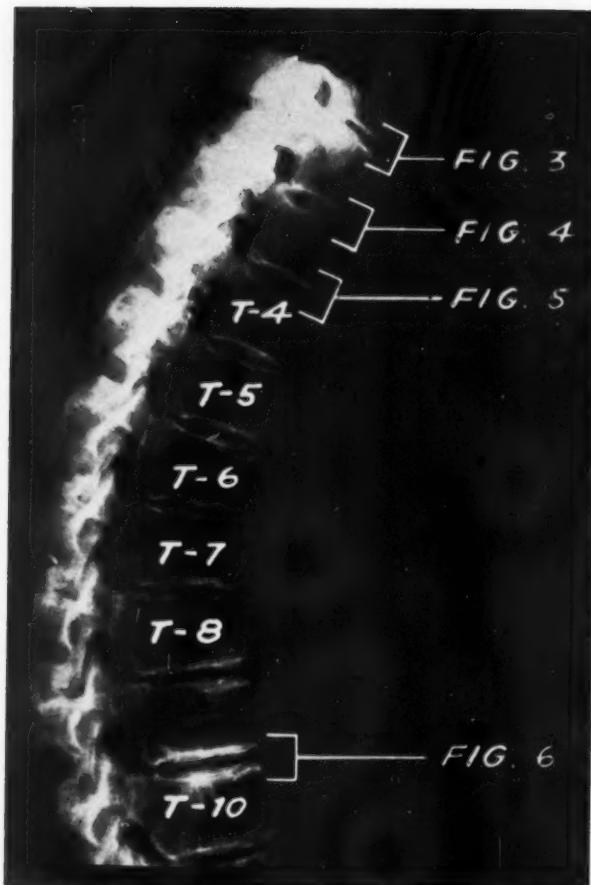


Fig. 2. Lateral radiograph of spine specimen prior to sectioning.

DISCUSSION

In patients with thoracic radicular pain, hypertrophic spurring may be erroneously considered to be reaching the neural foramina. Anatomical study and sections of the vertebral bodies show that the rib head and costovertebral articulations limit the extension of spurring. Although radiographic demonstration of the neural foramina of the thoracic spine can best be accomplished in the lateral projection (these structures, as in the lumbar area, face directly laterally), the costovertebral articulations are hidden by the overlying vertebral bodies and the relation of these joints to the foramina cannot be studied. In the

anteroposterior projection, adequate study of the posterior extent of spur formation is also prevented by the lateral bulge of the vertebral body obscuring the vertebral facets.

Serial sections through the vertebral bodies, intervertebral disk, and hypertrophic spurs of the thoracic spine best show the limitation of spur formation by the rib head.

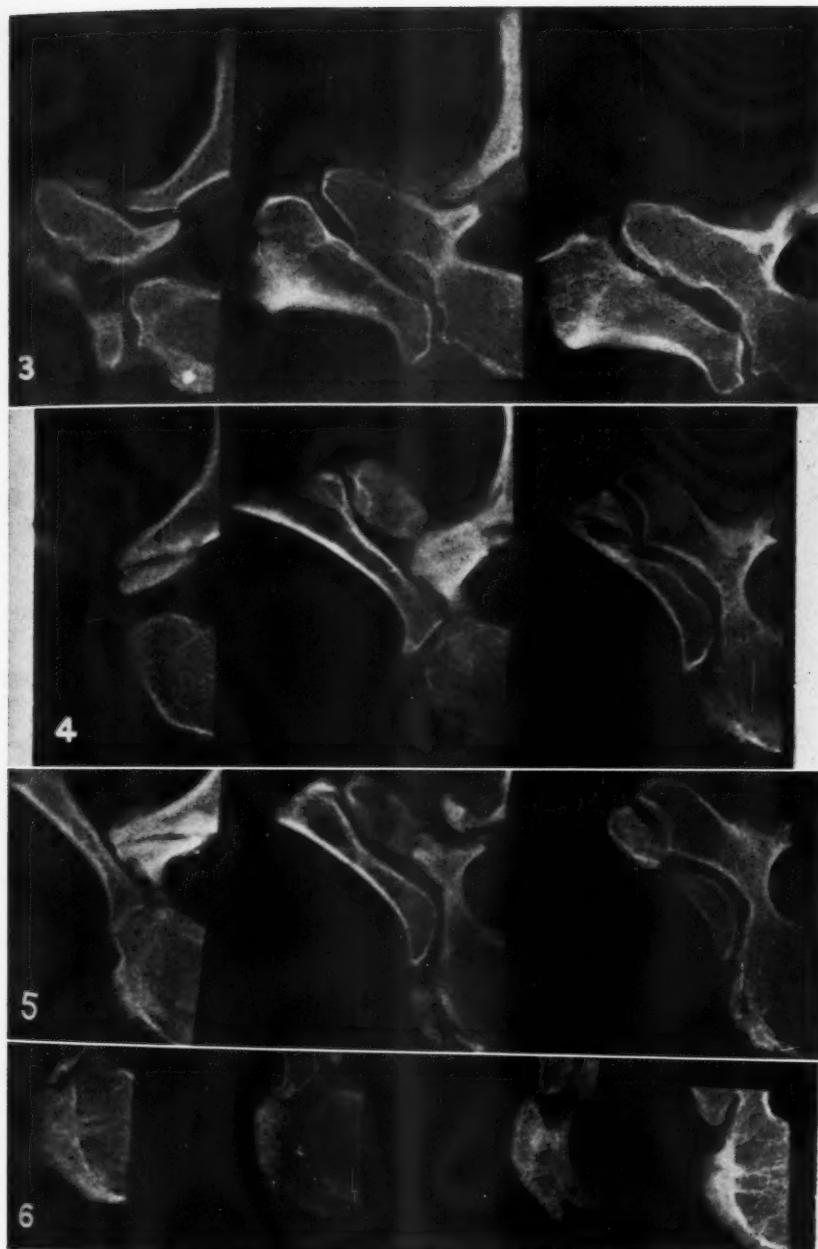
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Figs. 3-6. Serial sections of spine at various levels.

Fig. 3. Relation of the second rib head to the body and intervertebral disk at the level of the first thoracic intervertebral disk. Note that the anterior end of the rib reaches the level of the anterior aspect of the second thoracic vertebral body.

Fig. 5. Sour developans from the lateral aspect of the vertebral body. Bony structure reaches the level of the intervertebral disk between T-3 and T-4.

Fig. 5. Spur developing from the lateral aspect of the vertebral body. Bony structure reaches the level of the intervertebral disk but is limited by the rib head posteriorly. (Level of the disk between T-4 and T-5.)

Fig. 6. Marked spur formation from the lateral aspect of vertebral body. The lateral aspect of the intervertebral disk contains bone from the spur. The spur can be seen to rise over the anterior aspect of the rib head. The posterior elements of these vertebrae have been removed for separate study. (Level of the disk between T-9 and T-10.)

SUMMARIO IN INTERLINGUA

Limitation del Formation de Sporones Hypertrophic per le Articulationes Costovertebral

In patientes con dolores thoracico-radicular, le supposition erronee es facite a vices que sporones hypertrophic ha attingite le foramina neural. Studios anatomic e sectiones del corpos vertebral demonstra que le capite costal e le articulationes costovertebral restringe le extension del sporones. Ben que le visualisation radiographic del foramina neural del columna thoracic se effectua le melio in un projection lateral—iste structuras, como lor correspondentias in le area lumbar, es orientate directemente verso le lateres—le articulationes costovertebral es

celate per le superimponite corpos vertebral, e le relation inter le articulationes costovertebral e le foramina non pote esser studiate in iste typo de projection. In le projection anteroposterior, le adequate studio del extension posterior del formation de sporones es similemente prevenite per le extrusion del corpore vertebral que obscura le facietas vertebral. Sectiones serial a transverso le corpos vertebral, le disco intervertebral, e le sporones hypertrophic del columna thoracic demonstra le melio le limitation del formation de sporones per le capite costal.



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Eosinophilic Cystitis

Case Report of Eosinophilic Infiltration of the Urinary Bladder¹

A. J. PALUBINSKAS, M.D.

IN RECENT YEARS, a number of reports on eosinophilic infiltration of the stomach and/or upper intestinal tract have been published. To the author's knowledge, however, no instances of such involvement of the urinary tract have been recorded in the English literature. The purpose of this paper is to describe the clinical history and principal roentgenographic findings in a patient with eosinophilic infiltration of the urinary bladder.

CASE REPORT

G. E., a 31-year-old Caucasian housewife, was admitted to the University of California Medical Center for the second time on Aug. 12, 1959, because of swelling of the abdomen for one week. One year previously, she had been in the hospital for investigation of recurrent crampy abdominal pain associated with back pain, diarrhea changing to constipation, anorexia, weight gain, and swelling of the abdomen, all of six weeks duration. She stated that she was allergic to weeds and grass, which gave her rhinitis, and a family history of asthma was obtained (grandmother).

Findings at the time of the first admission, pertinent to the present report, included ascites, a tender, palpable mass on the right side on pelvic examination, and persistent eosinophilia up to 36 per cent. The urinary bladder appeared normal on intravenous urography. Roentgenographic examination showed a normal stomach, and the appearance of the small bowel was consistent with regional enteritis. On exploratory laparotomy, the entire small bowel was found to be thickened and covered with a fibrinous exudate. A segment of the ileum removed for microscopic examination showed dense infiltration of the bowel wall with eosinophils and perivascular round-cell infiltration. The pathologic diagnosis was eosinophilic enteritis.

Prednisone therapy was instituted and, after an uneventful postoperative convalescence, the patient was discharged under the continuing care of her physician. She remained relatively well thereafter until the onset of symptoms which led to her second hospital admission. Prednisone was discontinued in April 1959, and two months later an episode of "asthma" occurred, with wheezing. A month after this episode severe dysuria developed, with fre-



Fig. 1. Anteroposterior view of the urinary bladder with patient erect. Intravenous urogram obtained thirty minutes after injection of contrast material. Peripheral bladder outline indicated by arrows.

quency, polyuria, nocturia, and incontinence. These symptoms were somewhat relieved by medication prescribed by her physician. In the week prior to her second hospital admission, Aug. 12, 1959, periumbilical abdominal pain and abdominal swelling, such as had been observed the previous year, recurred.

The pertinent findings on examination on this second admission were a moderately protuberant abdomen, diffuse abdominal tenderness and rebound tenderness, an abdominal fluid wave, and symmetrical 1+ ankle edema. The white blood cell count was 27,200, with 80 per cent eosinophils; the sedimentation rate was 5 mm. in an hour, and urinalysis revealed a 4+ proteinuria, many epithelial cells, 0-3 red blood cells and 3-5 white cells per high-power field, and no bacteria.

The intravenous urogram demonstrated normal findings except for the urinary bladder, which showed a marked change from its relatively normal appearance one year previously. The bladder wall was remarkably thickened, in some areas to 3.5 cm. A diagnosis of eosinophilic cystitis was made. A cystometrogram indicated a thick, fixed bladder, and cystoscopy revealed a thick bladder wall with a normal trigone.

A bladder biopsy specimen was obtained which,

¹ From the Department of Radiology, University of California School of Medicine, San Francisco, Calif. Accepted for publication in February 1960.

on microscopic examination, showed dense infiltration of the stroma with eosinophils. The final pathologic and clinical diagnosis was eosinophilic cystitis.

DISCUSSION

Since Loeffler's original description in 1932 of eosinophilic infiltration in the lungs, which he considered transient and benign, further reports have demonstrated that this condition in some instances is neither transient nor innocuous (3). In addition, eosinophilic infiltration of other organs, especially the stomach and small intestine, has been noted (1-4).

The patient discussed above had proved eosinophilia with eosinophilic infiltration of the small intestine, with subsequent development of infiltration of the urinary bladder, associated with a marked eosinophilia.

The etiology of this uncommon disease is not known, but most authors believe that it is an allergic manifestation. The present patient gave a history of allergy to weeds and grass, asthma in the family (grandmother), and an episode of "asthma" with wheezing; a sensitivity to sulfa compounds was also suspected. No evidence of parasitism or other causes of eosinophilia were detected.

Symptomatology is dependent on the shock organs involved. The present patient's primary complaints on her second admission were referable to the urinary bladder but, in addition, she complained of symptoms similar to those on her first hospital admission. Apparently, besides the bladder involvement, there was a recurrence of eosinophilic infiltration of the intestines, although the last was not reinvestigated.

The primary roentgenographic finding pertinent to this report was a remarkable thickening of the bladder wall.

Apparently eosinophilic infiltration of the bladder is most uncommon, as this was the first recognized example in this hospital and also in the experience of the



Fig. 2. Post-voiding film of the bladder taken at the termination of intravenous urography. Note the remarkable thickening of the bladder wall.

author and his radiologic and urologic colleagues. Examination of patients with unexplained eosinophilia and symptoms referable to the urinary tract will, no doubt, bring to light further cases, and possibly examples of eosinophilic infiltration of the upper urinary tract as well.

SUMMARY

A report of an apparently rare disease process, eosinophilic infiltration of the urinary bladder, is presented, and the roentgen findings are discussed.

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SUMMARIO IN INTERLINGUA

Cystitis Eosinophile: Reporto de un Caso de Infiltration Eosinophile del Vesica Urinari

Es reportate un caso de infiltration eosinophile del vesica. Il pare que iste occurria es unic, ben que infiltration eosinophile del pulmones es ben cognoscite (Loeffler), e il existe reportos de simile formas de infiltration del stomacho e del intestino tenue.

Le presente paciente habeva essite vidite un anno previamente quando un laparotomia exploratori e le examine microscopic de un segmento del ileum habeva resultate in le diagnose de enteritis eosinophile. Le morbo occasionante le presente reporto

esceva characterisate per dysuria, polyuria, nocturia, e incontinentia, insimul con grados significative de eosinophilia. Un urogramma intravenose revelava un remarcabile spissification del pariete vesical. Le section de un specimen bioptic del vesica revelava un dense infiltration del stroma con eosinophilos. Esseva etiam notate indicationes del recurrentia del previe affection intestinal.

Le paciente reportava antecedentes de allergia. Isto supporta le conception que le condition es un manifestation allergic.



Anomalous Drainage of Pulmonary Veins into the Inferior Vena Cava

Importance of Planigraphic Study¹

WALTER KOCH, M.D., and ALFREDO SILVA, M.D.

THIS REPORT is concerned with the first confirmed cases of anomalous drainage of the right pulmonary veins into the vena cava to be observed in Chile and with planigraphic studies which were of considerable value in establishing the correct diagnosis. This condition has been well described previously in the literature (1-7).

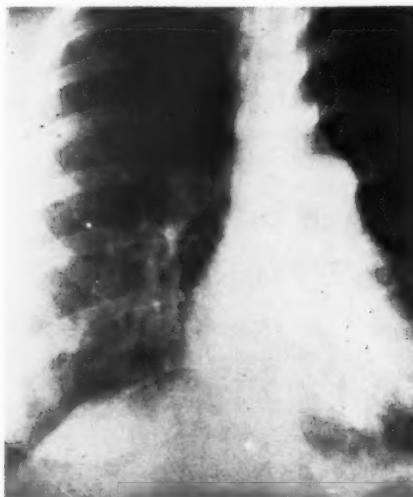


Fig. 1. Case I. Postero-anterior roentgenogram of the chest showing vascular channels crossing the lower pole of the right lung root and extending into the region of the right cardiophrenic angle, where they appear to join. The lung roots are not enlarged, but the undivided segment of the pulmonary artery is large.

CASE I: A white female, age 41, had for several years complained of dyspnea and palpitation on effort. Physical examination revealed accentuation of the second sound and a systolic murmur in the second and third left intercostal spaces. The blood pressure was 130/90; pulse 84. The electrocardiogram showed incomplete right bundle branch block.

A postero-anterior roentgenogram of the chest (Fig. 1) showed the vascular trunks crossing the right hilus and extending into the region of the right cardiophrenic angle, where they appeared to converge.



Fig. 2. Case I. Planigraphic study.

A. The veins from the upper lobe cross the area of the lung root and extend inferiorly. B. The anomalous venous trunk extends from the area of the lung root inferiorly to the level of the diaphragm.

The transverse diameter of the heart was not increased, but there was some enlargement of the undivided segment of the pulmonary artery. Planigrams of this region (Fig. 2) showed the convergence

¹ From the X-Ray Department and the Cardiovascular Team of the Carlos Van Buren Hospital and Viña del Mar Hospital, Valparaíso, Chile, South America. Accepted for publication in December 1959.

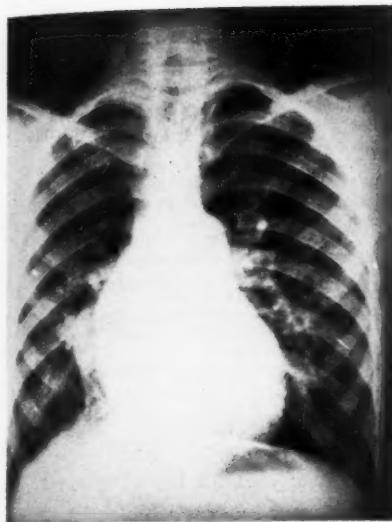


Fig. 3. Case II. Postero-anterior roentgenogram of the chest showing enlargement of the lung roots and of the undivided segment of the pulmonary artery. The right side of the heart is prominent. Paralleling the right cardiac border and extending into the right cardiophrenic angle is an anomalous venous trunk.

of the vessels with the formation of a large single trunk extending to the right cardiophrenic angle, increasing in size as it approached the angle.

At operation a common pulmonary venous trunk emptying into the inferior vena cava was found. Another minor vascular anomaly, consisting of three veins and two small arteries from the inferior mediastinal vessels to the inferior border of the lung, was also found. The right lung consisted of only two lobes, and subsequent bronchography showed anatomic variations of the bronchial tree. The surgeon inserted the anomalous pulmonary venous trunk into the left atrium and a subsequent planigraphic study demonstrated the change in course of the vessel. The patient has done well.

CASE II: A white male, age 12, had experienced dyspnea on exertion from infancy. There was no history of cyanosis, and he had participated actively in sports. In addition to evidence of cardiac enlargement, there was a holosystolic murmur, heard best in the second and third left intercostal spaces, radiating to the vessels of the neck. The second pulmonary sound was accentuated and split. There was no thrill.

A postero-anterior radiograph of the chest (Fig. 3) showed enlargement of the right side of the heart and the undivided segment of the pulmonary artery. The lung roots were enlarged. In the right paracardiac region was a vascular channel beginning just below the lung root, paralleling the right cardiac border and continuing to the level of the diaphragm.



Fig. 4. Case II. Planigraphic studies.
A. An anomalous vessel extends inferiorly from the region of the right lung root and parallels the border of the heart.

B. The inferior extension of this vessel is shown receiving additional branches.

Planigraphic study (Fig. 4) showed the large venous channel extending to the diaphragm and receiving several branches.

Cardiac catheterization established the presence of an interatrial septal defect. The catheter could be passed from the inferior vena cava into the anomalous vein, establishing its nature also.

SUMMARY

Two cases of anomalous venous drainage of the right lung to the inferior vena cava are presented, with associated congenital anomalies: in one anomalous distribution of the bronchi to the right lung and small anomalous vessels from the systemic circulation of the mediastinum to the right lung; in the other interatrial septal defect.

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SUMMARIO IN INTERLINGUA

Drainage Anormal de Venas Pulmonar a in le Vena Cave Inferior: Importancia del Studio Planigraphic

Es presentate duo casos de anormal drainage venose del pulmon dextere a in le vena cave inferior. Ambe le patientes habeva associate anormalitates congenite. Le un habeva un distribution anormal del

bronchos ad le pulmon dextere e micre vasos anormal ab le circulation major del mediastino ad le pulmon dextere. Le secunde habeva un defecto del septo interatrial.



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Right-Angle Scatter for X-Ray Beams of 0.14 mm. to 2.5 mm. Copper h.v.l.¹

AARON P. SANDERS, M.S., C. W. CHIN, B.S., K. W. SHARPE, B.A., ROBERT J. REEVES, M.D., and
GEORGE J. BAYLIN, M.D.

THE COMPUTATION of shielding requirements due to scattered radiation from a therapeutic installation is dependent upon data available in the literature. It is impossible to calculate accurately with the Compton equation the distribution and magnitude of scatter at any given point away from a scattering medium such as the human body. This is because the x-ray spectrum is a continuous one and the exact spectral distribution is not known accurately for each machine.

There are several reports in the literature relating right-angle scatter at 1 meter from the scatterer to the peak kilovoltage across the x-ray tube. Glasser *et al.* (1) give data compiled from several of these papers (2-5) relating right-angle scatter at 1 meter, in percentage of central beam dosage, for x-ray tube potentials of 75 kvp, 80 kvp, 200 kvp, and 1 Mvp, for selected port sizes. As indicated by the relatively small selection of data, the information in the literature is rather sparse. It was believed by the present authors that a practical approach to shielding requirements would be to relate right-angle scatter for x-ray installations to the half-value layer of the central beam. This paper reports the results of work performed in measuring right-angle scatter as a function of half-value layer over a range of 0.14 to 2.5 mm. copper.

METHODS

Measurements were made of the central beam dosages in air and of the right-angle scatter in air from a Westinghouse 220-kvp constant-potential machine and a Picker Vanguard 280-kvp pulsating-potential machine. A Model 570 Victoreen Condenser r meter and Model 130, 131,

154, 228, 326 chambers were used according to the dosage rate being measured. Care was taken to ascertain that the upper intensity limits of the condenser ionization chambers were not exceeded, thus avoiding recombination losses.

To obtain the right-angle scatter data, it was necessary that readings at the point of observation be taken with both open and closed shutter. In this manner the effects of leakage through the tube housing could be subtracted from the combined reading, which included both scatter and leakage radiation. A Preswood phantom 20 cm. thick by 30 cm. wide and 30 cm. long was used as a scattering medium to simulate scattering from the human body. The phantom material had a density of 1.0.

Right-angle scatter values were determined as a function of half-value layer and area of field at a focal skin distance of 50 cm.

RESULTS

Variation of right-angle scatter as a function of half-value layer in millimeters of copper is shown in Figure 1. The data there illustrated were obtained with the edge of the cone aligned with the edge of the phantom and at distances of 50 cm., 75 cm., and 100 cm., perpendicular to the central axis of the primary beam. Similar information is shown in Figure 2, with the edge of the cone parallel to but 4 cm. in from the edge of the phantom. It will be noted that when the edge of the cone is aligned with the phantom edge, the scattering is greater than in the second case. Figure 3 shows the right-angle scatter as a function of the half-value layer, with varying cone sizes, at 100 cm. from

¹ From the Department of Radiology, Duke University Medical Center, Durham, N. C. Accepted for publication in January 1960. This work was supported in part by U. S. Public Health Service Grant Number C-3418.

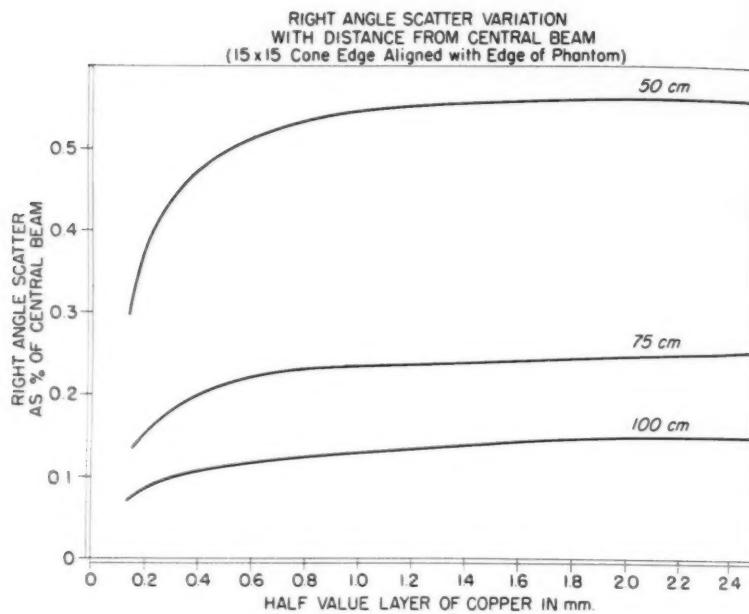


Figure 1

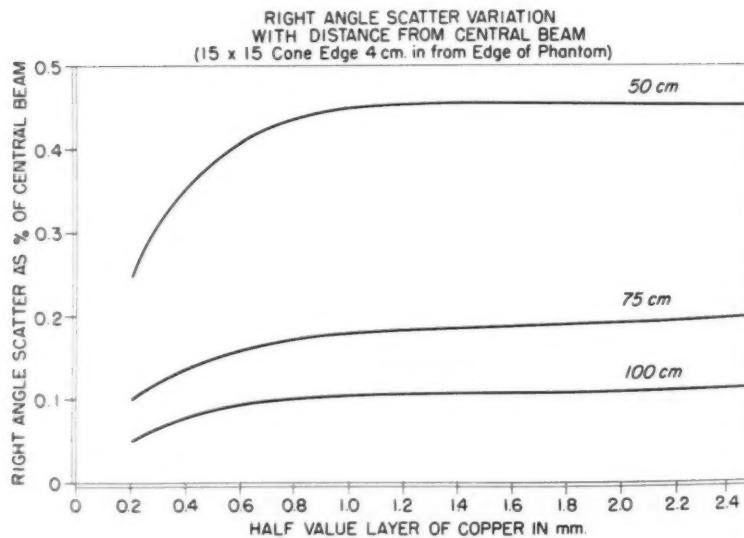


Figure 2

the central axis of the beam. Figure 4 shows the variation in right-angle scatter as a function of port size for half-value layers of 0.25 mm. Cu, 0.5 mm. Cu, 1.0 mm. Cu, and 1.5 to 2.5 mm. Cu.

DISCUSSION

Expressing right-angle scatter as a function of half-value layer appears to be a more logical approach to a practical utilization of this information. If right-

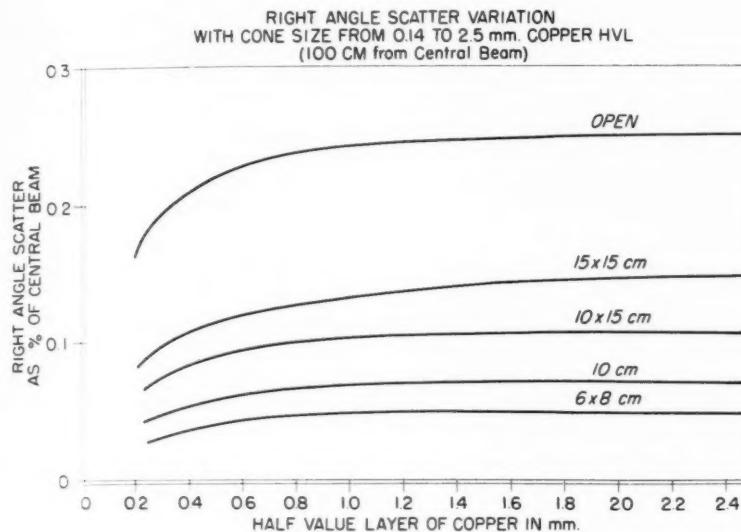


Figure 3

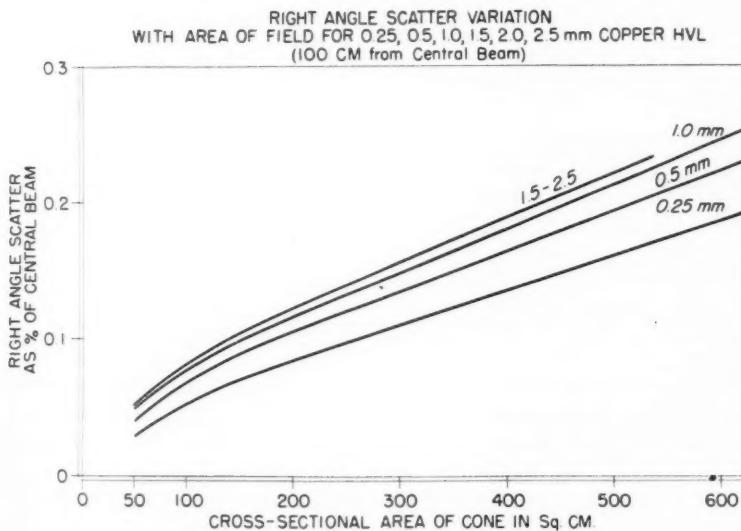


Figure 4

angle scatter is expressed as a function of kilovoltage, there could be obvious error in that one could use 200-kv x-rays and obtain beams of varying quality from approximately 0.3 to 2.5 mm. of copper half-value layer. Consequently, the effective spectrum of the beam would be varying significantly in energy. With variation

in energy, there would be a wide range of difference in the magnitude and energy of the scatter radiation.

In order to correlate these data with information relating to a particular machine, it is possible to relate approximate half-value layers, for constant-potential and pulsating-potential machines, to sev-

TABLE I: APPROXIMATE HALF-VALUE LAYERS

Oper- ating kvp	Added Filter	Approx- imate h.v.l. (Constant Potential)	Approx- imate h.v.l. (Pulsating Potential)
140 kvp	None	0.2	0.15
	0.25 mm. Cu + 1.0 mm. Al	0.6-0.7	0.4-0.5
200 kvp	0.5 mm. Cu + 1.0 mm. Al	1.1	1.0
	1.0 mm. Cu + 1.0 mm. Al	1.6	1.4
220 kvp	2.0 mm. Cu + 1.0 mm. Al	1.8	1.7
	Thoraeus I	1.6	1.5
250 kvp	Thoraeus II	1.9	1.8
	None	0.3	0.2
250 kvp	0.5 mm. Cu + 1.0 mm. Al	1.2	1.1
	1.0 mm. Cu + 1.0 mm. Al	1.7	1.5
250 kvp	2.0 mm. Cu + 1.0 mm. Al	2.1	1.8
	Thoraeus I	1.9	1.6
250 kvp	Thoraeus II	2.3	1.9
	0.5 mm. Cu + 1.0 mm. Al	1.5	1.3
250 kvp	1.0 mm. Cu + 1.0 mm. Al	2.0	1.8
	2.0 mm. Cu + 1.0 mm. Al	2.6	2.4
250 kvp	Thoraeus I	2.5	2.1
	Thoraeus II	3.0	2.7

eral peak kilovoltages for some typical operating conditions. These data are shown in Table I.

From these data, one may determine the right-angle scatter coefficient for x-ray machines operating in the region of 0.14 to 2.5 mm. of copper half-value layer. The calculation of secondary barriers may then be performed by direct computation.

SUMMARY

Right-angle scatter coefficients have been determined as a function of half-value layer (from 0.14 mm. to 2.5 mm. Cu), area of field, and perpendicular distance from the central beam axis.

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SUMARIO IN INTERLINGUA

Dispersion Rectangule pro Fasces de Radios X, de Spissitate de Medie Valor de Inter 0,14 e 2,5 mm de Cupro

Esseva effectuate mesuraciones del dispersion rectangule ab apparatos therapeutic de radios X a potential constante e a potential pulsante. Un phantoma de Presdwood esseva usate como medio de dispersion in simulation del corpore human.

Valores de dispersion rectangule esseva determinate como function de spissitate de medie valor e le area del campo a un distanta foco-pelle de 50 cm pro varie dis-

tantias perpendicular ab le axe del fasce central.

Super le base del datos presentate il es possibile determinar le coefficiente de dispersion rectangule pro machinas de radios X que fungo in le area de inter 0,14 e 2,5 mm de cupro de spissitate de medie valor. Le calculation del barrieras protectori pote alora facer se per computation directe.

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The Measurement with Chemical Dosimetry of Absorbed Integral Dose in Large Phantoms¹

L. H. GEVANTMAN, Ph.D., and J. H. ARNDT, B.S.

THE USE OF ion chambers inserted in tissue-equivalent phantoms made of wax, Preswood, or plastic, in measuring absorbed dose distributions, is a well established technic in radiation therapy (1). To obtain integral dose absorbed within such a phantom, it is then necessary to calculate and sum up the products of the isodose contours and the masses associated with them. In order to avoid this procedure, it is possible to resort to an expression derived by Mayneord (2) which gives an approximate value for the absorbed integral dose:

$$\Sigma = 1.44 D_s A d_{1/2} \left[1 + 2.88 \frac{d_{1/2}}{f} - \left(1 + \frac{2d}{f} + 2.88 \frac{d_{1/2}}{f} \right) e^{-(d/1.44d_{1/2})} \right]$$

where

D_s = surface dose

$d_{1/2}$ = depth at the 50 per cent isodose line

d = thickness of phantom

f = target to surface distance

A = area of the entrance field

Σ = integral dose

This does not include the radiation dose scattered outside the geometrical edge of the beam and is a low estimate of the integral dose. The recent development of reliable chemical dosimeters makes it possible to measure directly the integral dose absorbed in phantoms. This approach has the added advantage that large-volume dosimeters may be employed to imitate the clinical situation. The present effort was initiated to establish the validity of the calculated integral dose from a therapeutic irradiation investigation for resultant life shortening (3) by comparison with the dose absorbed in a full-sized phantom of a female trunk.

The phantom was made by heating and shaping 12-in. Plexiglas cylindrical tubing

of 0.317 cm. wall thickness to the desired dimensions, which were 24.2 cm. on the short axis and 34.9 cm. on the long axis by 39.4 cm. high. A Plexiglas plate was glued to one end. A polyethylene bag was used to line this vessel and act as a container for the dosimeter solution. This bag was previously given a dose of 10^7 rads to forestall its chemical reaction with the ferrous sulfate solution. The dosimeter solution (10^{-3} M Fe^{2+} , 10^{-3} M Cl^- in 0.1 N H_2SO_4) was stirred continuously during irradiation.

The phantom was irradiated in each of three orientations, through a lead collimator, giving a round field 16 cm. in diameter at a T.S.D. of 70 cm. Surface doses in the ratio of 0.72:1:1 were given for the front and two sides, respectively, as shown diagrammatically in Figure 1. A transmitted beam from a 1,000-kvp x-ray machine operating at 1,000 volts and 3 ma, with 0.5 mm. Cu filtration, was employed to deliver the doses desired. Three runs were made. Surface dose was measured with a standard 250-r thimble chamber for the last two runs. Following each exposure 20-ml. samples were taken from solution and measured for the Fe^{3+} produced. The change in absorption was read on a Beckman DU spectrophotometer at 304 millimicrons. Optical path lengths of 5 and 10 cm. were used to obtain significantly large readings. With this procedure the doses obtained were cumulative and the value obtained for the final orientation gave the total absorbed dose.

The results are shown in Table I and represent the integral doses observed in the phantom corrected to a surface dose of 3,600:5,000:5,000 r for orientations 1:2:3, respectively. This gives a final average value of $4.33 \pm 0.64 \times 10^7$ gram roentgens and may be compared with the value of

¹ From the U. S. Naval Radiological Defense Laboratory, San Francisco, Calif. Accepted for publication in February 1960.

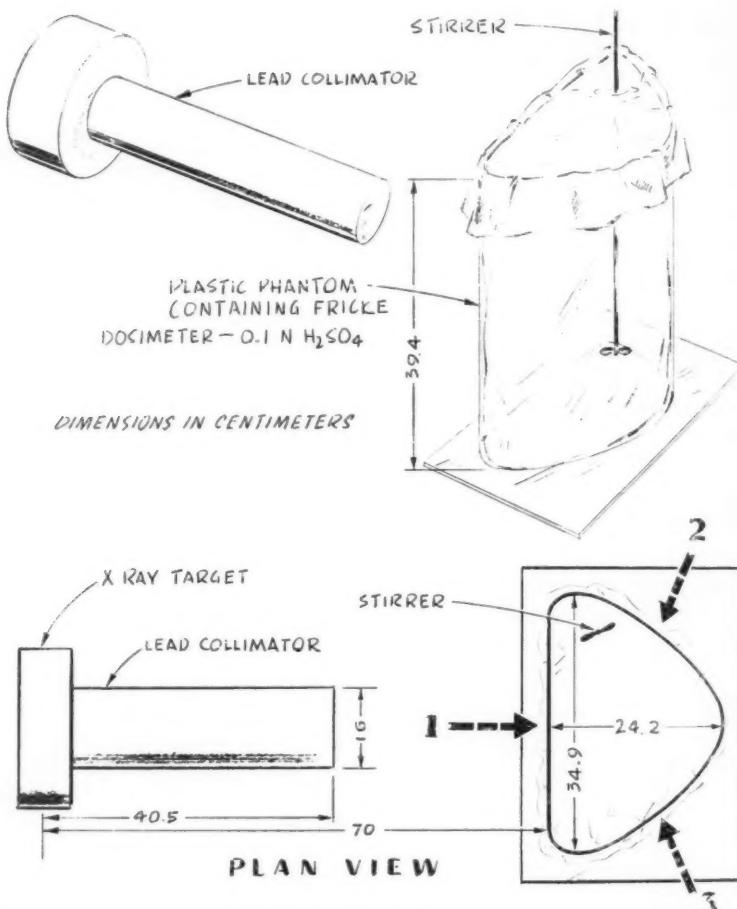


Fig. 1. Diagram of the phantom, showing its three orientations in the x-ray beam.

TABLE I: MEASUREMENT OF INTEGRAL DOSE ABSORBED IN PHANTOM* CONTAINING FERROUS SULFATE DOSIMETER

Run	Absorbed Dose† (Ergs/g $\times 10^4$)							
	Position 1	Average Value	Position 2	Average Value	Position 3	Average Value	Total	Average Value
1	3.6		4.9		4.63		13.13	
2	4.6		6.37		6.15		17.12	
3	3.85	4.02	6.06	5.77	4.60	5.13	14.51	14.92

* Total volume of phantom—24 liters.

† Doses given are based on a surface dose of 3,600:5,000:5,000 r in orientations 1:2:3 respectively.

2.4×10^7 gram roentgens calculated from Mayneord's expression. The latter value is low by almost 50 per cent, which confirms the necessity for considering the contribution made by the scattered radiation within

the phantom. The results are believed quite reasonable and demonstrate the feasibility of applying chemical dosimetry to the large scale measurements encountered in clinical therapy.

ACKNOWLEDGMENT: Our appreciation is expressed to Dr. R. R. Newell for the suggestion of the problem and for his aid in the execution of this work.

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SUMMARIO IN INTERLINGUA

Le Uso de Dosimetria Chimic in le Mesuration del Absorbite Dose Integral in Grande Phantomas

Le disveloppamento de fidel dosimetros chimic ha rendite possibile mesurar direcentemente le absorbite dose de radiation in un phantom. Tal mesuraciones esseva comparate con calculate doses integral (Mayneord). Pro iste objectivo un phantom de plastico esseva construite, comparabile al trunco feminin e revestite al interior de un sacco de polyethyleno continente le solution dosimetric. Isto esseva 10^{-3} M de Fe^{2+} , 10^{-3} M de Cl^- , in 0,1 N de H_2SO_4 . Le phantom esseva irradiate

in omne le tres orientationes. Super le base del valor final obtenite pro le dose absorbite, il esseva constatare que le cifras de Mayneord esseva troppo basse per quasi 50 pro cento. Isto confirma le necessitate de considerar le contribution facite per le disperse radiation intra le phantom.

Le resultatos demonstra le practicabilitate de applicar le metodo del dosimetria chimic al mesuraciones de alte ordine que es incontrate in le practica clinic.



Design and Performance of Field-Defining Apertures for Neutron Capture Therapy¹

E. E. STICKLEY, Ph.D., and L. E. FARR, M.D.

THE PURPOSE of this report is to present some of the special radiological problems which arise when a nuclear reactor or atomic pile is used in medical research and experimental radiation therapy. While there are many and various ways in which this new tool can be used, the principal emphasis here will be toward the means and the devices which are utilized in order to control the energy spectrum of the external neutron stream and to direct it selectively to the treatment site.

It has become possible to investigate these problems under practical conditions of use now that a nuclear reactor has been built expressly for and as an integral part of a Medical Research Center (1). Figure 1 shows the general external aspect of the Medical Research Center at Brookhaven National Laboratory, with the reactor housed in the cylindrical building in the background. The initial exploratory phase of its operation has turned up the acute problem of extracting from the machine the kinds and the numbers of neutrons required for experimental therapy, and the concurrent problem of keeping the gamma-ray contamination down to an acceptable level.

Except for some pertinent details of power level and neutron fluxes, the nuclear engineering aspects of the machine are not related here. The emphasis is instead placed on the machine as a device for studies on man and the diseases of man. Its design began with the establishing of criteria for the treatment situation in terms of human convenience as well as of radiation. The beginning point was the patient and a suitable radiation exposure room around him. The neutron aperture was stipulated to be at the appropriate location and to have the desired flow of

neutrons controlled by a shutter. The situation is thus entirely medical in nature; the reactor was designed to provide the factors demanded. Other conveniences were, of course, included, and flexibility of application was built in at every possible point. Other kinds of investigation are planned and still others—as yet not imagined—must surely present themselves.

The reactor will run typically at a power of 1,000,000 watts (1 megawatt). Performance of the reactor has actually been satisfactory in terms of its internal and operational characteristics. Its pattern of control, heat transfer, and other engineering attributes have been good enough that permission has been granted to run at power levels up to 3 megawatts. For the typical operating condition at the 1-MW power level, central core flux figures are greater than 10^{13} n/cm.²·sec., as predicted.

On the other hand, the primary reason for building this reactor is to use streams of neutrons external to the reactor shield. To provide for this, the design includes specialized shielding components to minimize the delivery distance. The channel combines elements arranged for best neutron optics, planned from studies made during the criticality experiments. This required an extrapolation from pilot experiments at a power of 1 watt to actual operation at 1,000,000 watts. In addition, the translation of tests and plans into actual construction required compromise on a variety of details.

Flexibility was retained in the design to allow adjustment of operating conditions and to provide for incorporation of advances in the nuclear art as they become available. In particular, most of the elements existing along this useful neutron

¹ From the Brookhaven National Laboratory, Upton, L. I., N. Y. Presented at the Forty-fifth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Nov. 15-20, 1959.

Research supported by the U. S. Atomic Energy Commission.

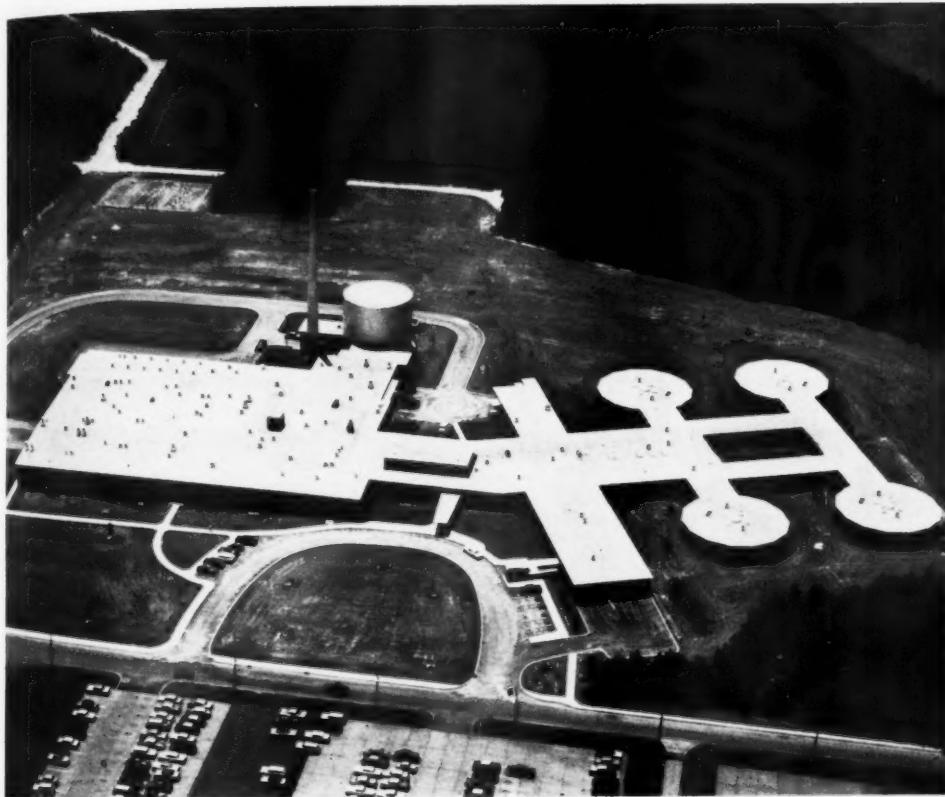


Fig. 1. Medical Research Center, Brookhaven National Laboratory. To the right are the four circular 12-bed nursing units with the hospital service area to the left. To the far left is the main laboratory building and just beyond is the cylindrical building in which the reactor is housed, with a stack for the cooling air alongside.

path are more or less exchangeable in optimizing the output.

To state first the general principles involved, it is necessary to point out only two things. The first is that the mean energy of a stream of neutrons will depend for the most part on their source and on the nuclear properties of the moderating materials through which they pass. This last concept includes the slowing down and the capturing tendencies which each isotopic species displays toward the neutron as it passes by. These are properties which vary widely, depending on the neutron energy. The second aspect has more to do with conserving and shepherding the neutron stream so that it is directed into the useful region. This involves thinning out the reactor's reflector, cutting

a channel through the shielding, and lining the path with materials which reflect stray neutrons back into the beam. In all these things, it is of greatest importance to reduce deleterious side effects, the worst of which is the creation of intense gamma radiation as a result of neutron capture and activation along the way.

Figure 2 gives details of the path of the neutrons from reactor core to patient. In this diagram the core is on the left, encased in a thick reflector made of graphite. In a reactor, all neutrons are born fast; since this reactor is one which requires slow neutrons for its operation, cooling water and the graphite pieces are arranged in the core, together with the surrounding reflector graphite, to work together in thermalizing the neutron population. For

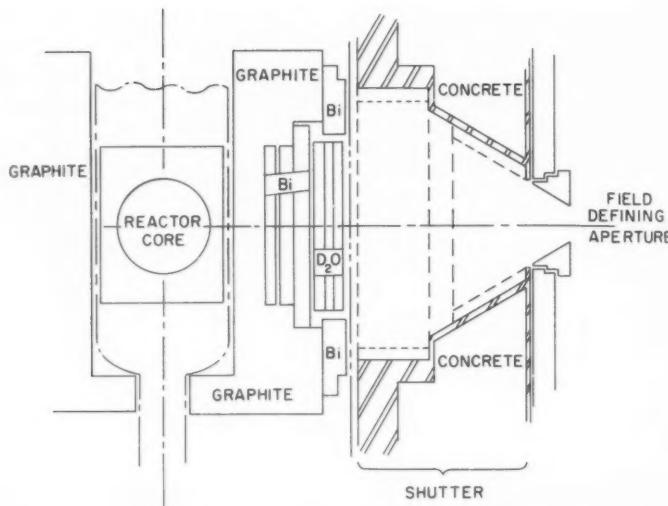


Fig. 2. Path of the neutron stream from reactor core to aperture in patient irradiation vault.

these experimental purposes, a "leakage" path is provided, proceeding toward the right of the diagram. In this direction, part of the graphite is removed. In its place large pieces of bismuth serve as a gamma-ray filter, and tanks for heavy water (D_2O) are placed as a moderator for adjustable control over neutron energy.

The area showing dotted outlines is the large funnel-shaped volume which is the "open" part of the shutter. It is here that further adaptation can be made in the interest of adjusting neutron energy, improving the quantity of neutrons delivered, and reducing the unwanted radiations which contaminate the useful output.

Various geometries and combinations of materials were tested during the preliminary criticality experiments to establish the pattern for initial operation. Translation to the medical research reactor required extrapolation to 1,000,000 watts from a closely similar reactor experiment run at 1 watt. To establish the validity of this extrapolation, further studies have been made and will continue to be made with the actual machine at full power.

The largest aperture possible here is 40 cm. square. The design of the funnel or cone in the shutter block is such that fair

uniformity should be possible over the central 20-cm. square. In view of this feature, a semipermanent shield surrounding the treatment aperture now accepts fittings or cones which are 10 inches square on the outside; that is, the hole in the wall where the neutrons emerge is 25 cm. square.

Two treatment cones are shown in Figure 3, one facing forward, the other reversed to show the offset which fits into the aperture. For some purposes an additional bismuth filter has been at times placed in that spot, requiring other registration means to be devised. These fixtures are of paraffin filled with lithium fluoride; they provide an 8×8 cm. field and a circular field of equivalent area.

There has always been an extensive animal program in parallel with human studies. One of the most interesting results has come out of the series (begun at the older reactor) in which tumors growing in mouse thigh muscle have been treated by the neutron capture therapy modality. A shielding block protects the body of the mouse while the affected limb is exposed. Complete regression of tumor has been achieved with uncomplicated restoration of the normal structures in some of these experiments. This block was likewise

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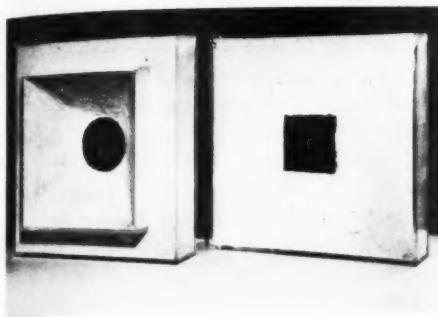


Fig. 3. Inserts or "treatment cones" made of paraffin and lithium fluoride; they fit into the aperture and provide the desired field shape.

amples which occur in treating areas around the head are the eyes, the parotid, the ears—which tend to protrude into the field. In general, the skin is also a protection problem, especially in a rationale which depends upon a local *exclusion* (rather than a preferential uptake) to provide the difference in target element concentration between malignant and healthy tissues. Skin flap and bone flap reversal techniques are part of the medical aspect of this developmental study.

Both the quantity and the quality of the available neutrons must be measured in

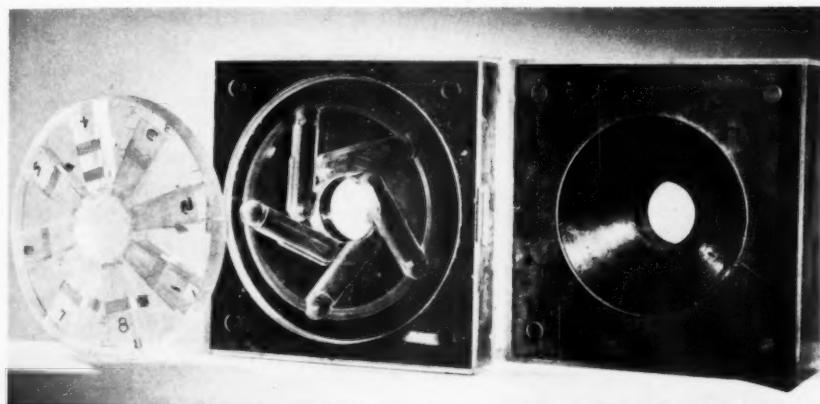


Fig. 4. Mouse exposure holders for either head or thigh irradiation.

fashioned of paraffin loaded with lithium fluoride. In the arrangement in Figure 4 boron carbide is used in the matrix to limit or soak up neutrons where they are unwanted. Boron is more efficient in this respect, but it gives an immediate gamma radiation in effecting the capture. Alternative holders for thigh or head irradiations are shown. Rabbit studies have been done using the same ports as for man, with special immobilizers.

The specific topic dealt with here is the development of means to control the neutron distribution patterns as delivered to the therapy site and as spread out through tissue. A corollary to this is the necessity to arrange local shielding for the protection of nearby structures which must be spared the full intensity of the radiation. Ex-

detail. In a parallel situation, the extensive character of any complete approach to the equivalent study in a "simple" x-ray treatment pattern will be recognized. In the x-ray case, over the years, we have learned to make practical use of certain comparatively direct detection phenomena—notably the absorption or half-value layer variation as the electromagnetic radiation traverses tissue.

Knowing numbers and kinds of neutrons is not the whole story. The radiation dose delivered or absorbed is the basic physical quantity which must be known for full study and understanding of the observed biological effect. To know the radiation dose, it is also necessary to have a good measurement of the amount of neutron capture target present at all points

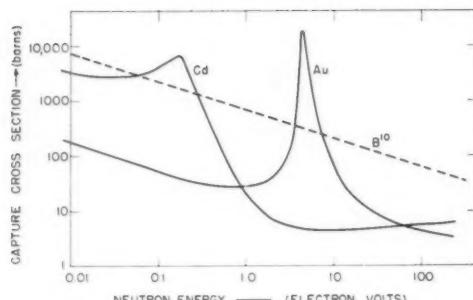


Fig. 5. Nuclear cross-section or reaction efficiency between neutrons and gold, cadmium, or boron 10.

of interest. Difficulties and complications of chemical, physiological, and pharmacological nature intervene at this point.

Alternatively, it is frequently proposed that direct measurement of the energetic heavy particles, as mediated by the neutrons, can be accomplished by the use of scintillators on light pipes, or the newer solid-state detectors doped or shielded to enhance response for these radiations.

The tools which are available include a few simple ones such as neutron activation foils and tissue-equivalent ionization chambers. Other more complex apparatus can also be invoked, such as diffraction spectrometers and "time-of-flight" beam choppers. It is also useful to observe the gamma-ray population by pulse-height analysis methods, for the energy of the gamma ray can indicate its point of origin in the structure. Simple gamma-ray measurements are made in the presence of neutrons by surrounding Victoreen or Landwerk ionization chambers with an inch of natural lithium metal. Relative populations of higher-energy neutrons are established by threshold foils, or by twinned U^{235} - U^{238} ionization chambers.

Neutron activation foils are of special value by virtue of their selective reactions with neutrons of characteristic energies. As a measure of neutrons which are useful in terms of their capture by boron 10, gold is especially adaptable. There is a parallelism in the cross-sections (or reaction efficiencies) for the two materials. In the graph reproduced in Figure 5, the cadmium

response is also shown to point out the way in which cadmium can be used, as a filter, to provide a differential measure giving a correction for the peak in the gold curve which lies just above the thermal region. Gold has the further advantage that it is a clinically acceptable material for insertion in the patient during neutron irradiation by technics familiar to the neurosurgeon. Gold wires and gold foils can thus be used extensively to explore tissue-equivalent phantoms to establish neutron penetration patterns. Two such patterns to illustrate this main point are shown in Figure 6. These isoflux curves were deduced by placing thin gold wires throughout a solid tissue-equivalent phantom of simple geometrical shape. Each pattern was interpolated from determinations made at nearly a hundred points lying in the central horizontal plane.

Exposure for this experiment was made under typical conditions, with the "treatment cone" of Figure 3. The central axis neutron flux is seen to fall off to 1 per cent in 10 cm., or we can see a "half-value" thickness of just under 2 cm. Care is indicated in writing down factors such as these, since the extent of the medium and back-scatter effects exert a strong influence, as we shall show in a moment. In this diagram there is a fairly symmetrical arrangement of the lines, but the logarithmic nature of the information should be noted. This is best seen along the central axis.

Figure 6, B shows the degree of protection which can be provided by local shielding. Part of the field was obscured by a plate of lithium metal 1/16 inch thick. In the region immediately behind the shield, say midway to the edge of the phantom, losses of neutron flux density of greater than half are evident. This is the sort of arrangement used to give special protection to an eye, or an ear, or other structure, if it is near the field. The 1/16 inch of lithium is the least we have available—two or more thicknesses are sometimes used. With enriched lithium 6, these same thicknesses could be perhaps

Fig. 6

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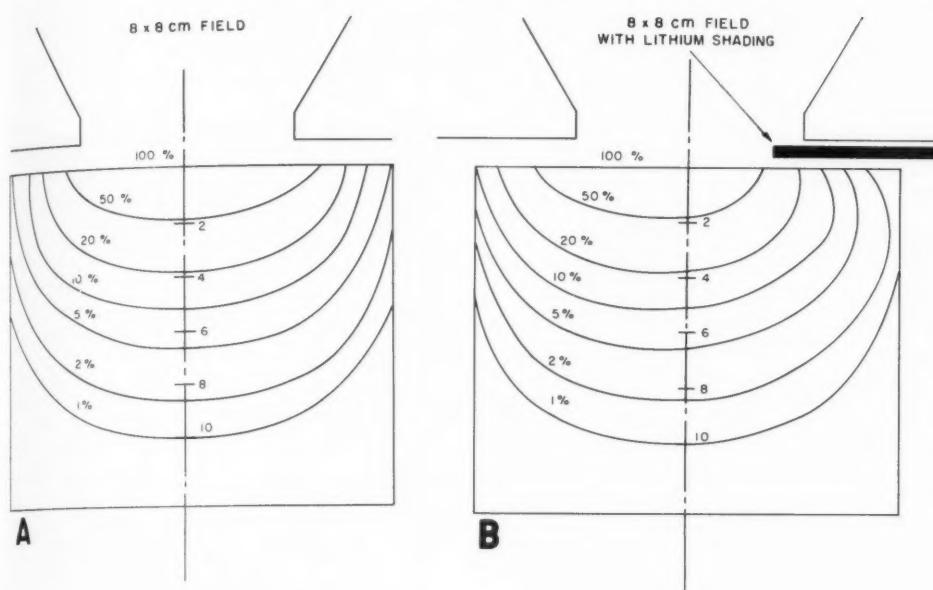


Fig. 6. A. Slow neutron isoflux contours in tissue-equivalent phantom exposed in field of the 8×8 cm. port.
 B. Similar pattern with the neutron field altered by local shielding with $1/8$ inch of lithium metal.

ten times as effective. The use of such materials can distort the whole field and also cause loss of a considerable fraction of the neutrons by a "sink" effect. The minimum amount used here did not cause a serious loss; the central axis values are nearly identical with the preceding.

By way of summary, it can be said that paraffin or plastic materials are useful in directing the flow of neutrons and, when

loaded with strong neutron-capturing materials, such as lithium or boron, they serve effectively to limit the field. The pure metal lithium is valuable in providing local protection.

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SUMMARIO IN INTERLINGUA

Le Architectura e le Comportamento Effective de Aperturas de Definition del Campo in Therapia a Capturation de Neutrones

Le Centro de Recercas Medical al Laboratorio National Brookhaven include un reactor nucleari planate e construite pro le objectivos de recercas medical e pro le experimentation in le campo del therapia radiational. In su functionamento practic, duo principios general es implicate. Le prime es que le energia medie del fluxo de neutrones depende in alte mesura del fonte e del proprietates nucleari del materia moderatori per le qual illo transi. Le secunde ha a facer con le preservation e le

orientation del fluxo de neutrones de maniera que illo arriva de facto in le region de su utilitate.

Ha essite trovate que paraffin e plasticos es utile in diriger le fluxo del neutrones, e quando iste medios es cargate de materiales como lithium o boro que ha un forte capacitate de capturar neutrones, illos servi efficacemente a limitar le campo. Lithium como metallo pur es de valor in provider protection local, pro le oculos, le aures, e le glandula parotidic.

Reduction of Fetal Irradiation in Pelvimetry¹

TOM A. KENDIG, M.D.

WITH THE growing concern regarding possible hazard to the fetus resulting from irradiation during gestation, it has become increasingly apparent that more attention to the fetal dose delivered during pelvimetry is indicated. Studies by Stewart *et al.*, Lewis, and others (1-3) suggest an increased incidence of neoplasia in children who have received radiation *in utero* incident to pelvimetry. The significance of these data is not yet documented, and it may prove that no actual relationship exists. However, the general awareness of the public and the nonradiologist physician requires that the radiologist direct his attention to this matter. Both parents and physicians have expressed increasing concern in this respect and demonstrated a real reluctance to accept pelvimetric examination because of possible radiation hazard to the unborn child.

The two possible solutions of the problem are to omit pelvimetry altogether or to take steps that will radically reduce the fetal exposure. In the conventional examination, as done in most institutions and radiological offices, no attempt has been made in the past to spare the fetus. In the triangulation method (5, 6) two 14 X 17-inch roentgenograms are obtained, with the fetus usually receiving total-body irradiation (Fig. 1). The dose received in connection with these two projections has been variously estimated at from 1,600 to 9,000 milliroentgens (4). The justification for this type of examination has been that one can gain information as to fetal position and station, presence or absence of multiple pregnancies, and possible fetal anomalies. Actually, however, in only a fraction of pregnancies has pelvimetry been done, and only a small segment of the fetal population has been so evaluated. By far the majority of pregnancies are carried through to term without



Fig. 1. Roentgenogram demonstrating the area of the maternal abdomen usually included in the anteroposterior view in a pelvimetry study. A similar area is, as a rule, included in the lateral view. In these projections virtually the entire fetus is exposed to total-body irradiation.

this information being available or needed. It is believed that the slight gain provided could well be dispensed with if we could thus drastically reduce fetal exposure.

In the author's experience in several thousand cases he has failed to find that a knowledge of the fetal head size has significantly altered the prognosis from the pelvimetric standpoint. Such knowledge he has used solely for assessment of fetal age when information on this point was needed in the presence of some condition requiring premature induction of labor or in explanation of what appeared to be a prolonged period of gestation. For this reason, it is felt that one can dispense with any information regarding the fetal head without significant detriment to the

¹ From the Department of Radiology, Harriman Jones Medical Clinic and Hospital, Long Beach, Calif. Accepted for publication in January 1960.



Fig. 2. In the anteroposterior projection the roentgen beam is precisely coned to an 8 \times 10-inch field centered at the suprapubic area. A leaden apron covers the maternal abdomen, with its lower edge extending to the superior margin of the field. A lead shield is placed in the cone aperture to obscure the fetal head. As is noted, there is virtually no direct exposure of the fetus.

pelvimetry study. In the few instances where specific information as to fetal head size or relation of the fetal head to the pelvis is required, the examination can be altered accordingly.

To attain our goal in the triangulation method of pelvimetry the attempt has been made to reduce fetal exposure by use of precision centering, precision coning, use of small fields, and use of a lead shield introduced into the cone to cast a shadow over the presumed area of the fetal head. In addition, the portion of the fetus above the field of exposure is protected by a flexible leaden shield placed over the maternal abdomen to prevent additional scattered radiation from reaching this area.

Precision coning has been achieved by use of a visualizer type of cone which defines the field of radiation and permits its precise centering to the area of interest.² Metal diaphragms of various sizes are inserted to restrict the field as desired. In the anteroposterior projection the central

²In this hospital we use a Dupla-Ray Visualizer Cone manufactured by Cummings X-ray Company.

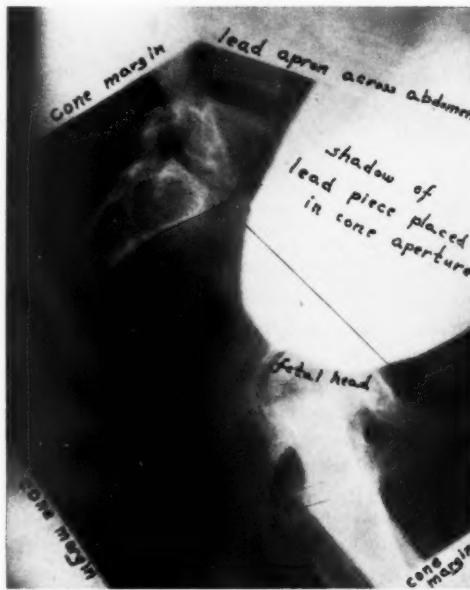


Fig. 3. An approximately 10 \times 12-inch field is projected obliquely on an 11 \times 14-inch film. This is centered precisely to the maternal pelvis with the fetal head obscured by a lead shield placed in the cone. A leaden apron covers the maternal abdomen in the upper portion of the field. Only a small portion of the fetal head is included in the direct beam.

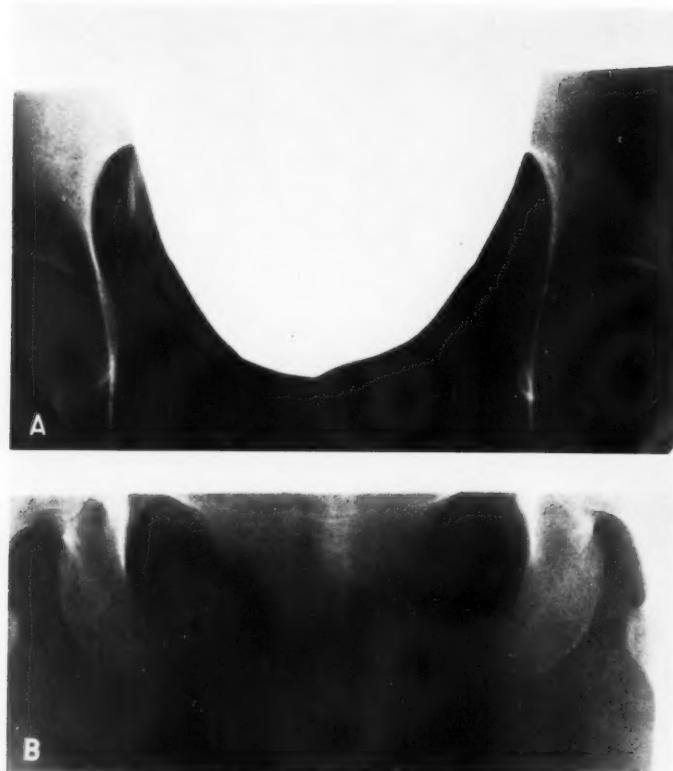


Fig. 4. A. Faulty placement of the film so that the ischial tuberosities are not included in the study. As a result, the bi-ischial diameter could not be obtained from this view.

B. A second roentgenogram includes only the ischial tuberosities, a very narrow cone being used so that no additional direct exposure to the remainder of the maternal pelvis or fetus is obtained. By this method of including portions of the pelvis erroneously omitted on the original examination, the fetus is spared additional irradiation. Careful attention to centering of the cone on the original examination and precise placement of the film should prevent the necessity of such additional views.

beam is directed to the suprapubic area for an 8 × 10-inch roentgenogram, with precise coning to this field size. The lower two-thirds of the pelvic inlet, the ischial spines, and ischial tuberosities are included in this field. There is inserted in the cone a leaded shield that casts a shadow over the fetal head so that only a small portion of it and none of the remainder of the fetus is exposed to radiation (Fig. 2). A leaded apron placed across the abdomen, with the lower edge extending to the upper margin of the field, prevents any additional radiation from reaching the fetus except that scattered within the patient.

In the lateral projection a field of approximately 10 × 12 inches is used, being projected obliquely onto an 11 × 14-inch roentgenogram, the obliquity of the field corresponding to the obliquity of the pelvic inlet. Again a leaded shield in the cone is used to protect the presumed area of the fetal head and an apron is placed across the patient's abdomen to the upper margin of the field, completely covering the rest of the fetus (Fig. 3).

These two views result in virtually no fetal exposure except for a varying portion of the vertex of the skull as seen in the roentgenograms. Only a small portion

of the fetal head receives any appreciable radiation, and the total-body irradiation is virtually eliminated. The gonadal dosage, unless the fetus happens to be in breech presentation, is virtually nil.

This technic could be adapted to any type of coning system, though a visual localizer type of cone permits more precise coning and more exact centering. It is obvious that with this approach more precision in obtaining the roentgenograms is required but the demands in this respect are not necessarily greater than in other examinations, as for example in mastoid study. It is necessary to convince the technician of the importance of a precise technic in order to eliminate retakes, as the latter will defeat the purpose of this type of study. Initially it is probably advisable that the radiologist personally assist in positioning the patient in order to develop a satisfactory technic. There should rarely arise occasion for repeating a view if sufficient time and effort are directed toward obtaining the correct roentgenograms initially. In approximately 100 examinations we have only twice failed to obtain a satisfactory study, and in these instances have repeated only exposure of the area missed, totally eliminating other portions of the pelvis on the repeat view and not adding appreciably to the fetal exposure (Fig. 4).

The accompanying roentgenograms are believed to document well the difference in fetal exposure resulting from this type of examination as compared to the conven-

tional examinations. It should be obvious that this approach to pelvimetry results in a drastic reduction in fetal exposure.

SUMMARY

It is important to recognize the growing concern as to the possible significance of general body irradiation of the fetus in the course of pelvimetry. To reduce this appreciably there are only two really satisfactory alternatives, either to eliminate the procedure entirely or to refine the technic so that the fetus obtains only a fraction of the exposure incident to the more conventional method of pelvimetry. This latter object has been achieved to a highly satisfactory degree by precision coning, precision centering, masking the area where the fetal head lies, and protecting the remainder of the fetus by a leaded apron placed over the maternal abdomen.

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SUMARIO IN INTERLINGUA

Reduction del Irradiation del Feto in Pelvimetria

Es importante recognoscer le facto de un crescente disquietude del parte del population laic, del medicos in general, e del radiologos con respecto al signification possibile del irradiation del corpore total del feto in le effectuation de pelvimetria. Es opinare que un notabile alleviation de ille disquietude pote effectuar se per solmente un de duo vermente satisfacente alternativas, i.e. eliminar le methodo com-

pleteamente o raffinar le technica de maniera que le feto recipe solmente un fraction del exposition associate con le manovras conventional del pelvimetria. Iste secunde objectivo ha esse realisate per precision del conage, per precision del centration, per mascation del area ubi se trova le capite del feto, e per proteger le resto del feto per un avantal a plumbio que es placiate super le abdomen del matre.

Detection of Foreign Bodies in the Anterior Chamber of the Bulbus Oculi¹

MORRIS J. MINTZ, M.D., and MAX W. MATTES, M.D.

WHEN AN intra-ocular foreign body is suspected, the commonly accepted routine is to obtain postero-anterior and lateral roentgenograms of the affected orbit. If no opaque foreign body is demonstrated, further investigation is probably not done unless the patient shows continued inflammation in the eye. It is the purpose of this paper to urge that a bone-free view of the anterior segment of the eyeball be made part of the routine examination in every case where no foreign body is found in the usual projections.

Foreign bodies that enter the eye may lodge anywhere within the eyeball or pass completely through it and become arrested in the retrobulbar space. Small foreign bodies, either magnetic or non-

magnetic, may enter the eyeball with only slight force and, therefore, often remain in the anterior segment. On routine frontal and lateral views, these may be completely missed in spite of radiographs of excellent quality. We are here reporting a case to illustrate this point and to suggest a method for the detection of anterior foreign bodies, thereby preventing unnecessary embarrassment to the radiologist.

CASE HISTORY

While chipping metal, the patient was struck in the eye by a fragment of the material upon which he was working. A small wound was produced at the limbus, and what looked like an intra-ocular foreign body was seen in the angle of the anterior chamber. The patient was referred for a localization study, but postero-anterior and lateral roentgenograms failed

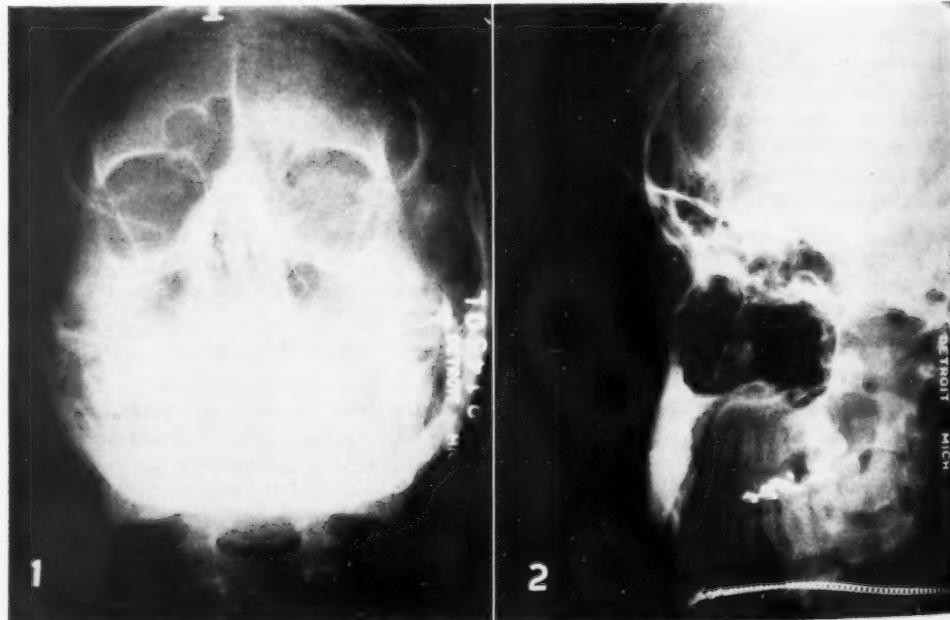


Fig. 1. No opaque foreign body discernible in routine postero-anterior or Waters view.
Fig. 2. No opaque foreign body discernible in routine lateral view.

¹ From Brent General Hospital, Detroit, Mich. (M. J. M., Attending Ophthalmologist; M. W. M., Radiologist). Accepted for publication in February 1960.

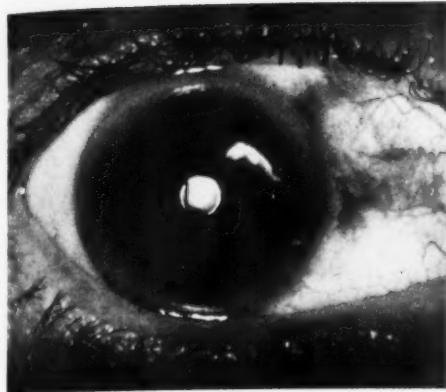


Fig. 3. Foreign body in vitreous.

to reveal any opaque foreign body. Anterior segment bone-free radiography, however, showed a metallic foreign body. Since the foreign body was visible, localization was not necessary.

DISCUSSION

The anterior segment bone-free method of radiography is well known. It was first described by Vogt. A piece of dental film is placed as far into the orbit in the medial canthus as possible and is held there by the patient. The x-ray tube is centered on it from the side, and the exposure is made. If further localization is needed, as might have been true in the case presented, the film can be placed, for example, in the inferior fornix, either under or outside the eyelid, and pressed in deeply, while the exposure is made from above. Thus a foreign body may be identified from two 90° angles. More definitive localization could then be obtained with a Sweet localizer.

In the case presented, since the foreign body did not show on the routine films, it certainly could not have been localized by the Sweet method or any of the usual localization techniques. A recent report by Turtz and Mamelok advised anterior segment radiography for recognition of non-radiopaque or weakly radiopaque substances entering the eye, such as lead from a pencil or glass. Although the bone-free technic described is limited to the anterior chamber, certain ingenious methods of injecting 2 to 3 c.c. of 1 per cent Novocain



Fig. 4. Anterior segment bone-free view showing metallic foreign body not identifiable in routine posteroanterior and lateral views.

into the retrobulbar tissues on the temporal sides have been proposed. This is done to produce an artificial exophthalmos, thereby exposing a greater portion of the eyeball on the roentgenograms.



Fig. 5. Actual size of metallic foreign body.

Attempts were made to determine if small metallic foreign bodies in the anterior chamber might not be obscured by slight movement in the fluid, and by the overlying skeletal structures. A small metallic foreign body was placed in a ping-pong ball filled with fluid comparable to the vitreous, the ball was then placed in the orbit of a dried skull, and radiographs were taken in various positions. It was readily seen that, with motion of the fluid and of the enclosed foreign body, recognition may indeed be difficult.

SUMMARY

An intraocular foreign body not shown on the usual postero-anterior or lateral view was revealed by bone-free radiography of the anterior segment. The bone-free view is recommended as a routine when foreign bodies in the eye are suspected but are not otherwise demonstrated.

NOTE: Acknowledgment is made to Dr. Ernest Gaines for the photography.

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SUMMARIO IN INTERLINGUA

Detection de Corpores Estranis in le Camera Anterior del Bulbo Ocular

Un corpore estraneo intraocular, non visible in le usual expositiones antero-posterior o lateral, esseva revelate per radiographia sin osso in le segmento anterior. Iste methodo es recommendate

pro casos in que un corpore estraneo in le oculo es suspicite sed non pote esser demonstrate per altere methodos. Le technica es applicabile solmente a casos de corpores estranei in le segmento anterior.



Storage Facilities for Radioactive Materials: Practical Homemade Units

R. S. CLAYTON, M.D., and H. A. DuBOSE, JR.

BECAUSE OF widely varying requirements for the storage of radioactive materials, and the few types and relatively high cost of commercially available safes, we believe a description of some practical and locally constructed facilities may prove of value. In the interest of brevity, a minimum of description will be presented, since the illustrations are largely self-explanatory.

GENERAL REQUIREMENTS

Storage facilities for radioactive materials should provide the following:

1. Adequate protection for personnel, depending upon the types and maximum amounts of radioactive materials which may be on hand at any one time.
2. Security against loss and accidental exposure to radiation.
3. Adaptability to the varying requirements of individual circumstances.
4. Economy through simple design and use of locally available materials.
5. Efficiency. Storage safes should be easily opened and closed to provide for rapid removal and insertion of radioactive materials to minimize the time during which these materials are not behind protective barriers. The barriers should be sufficiently thick to permit close proximity of storage safes, loading bench, and the transport cart.

STORAGE SAFE

Construction: Photographs and construction details of a storage safe are shown in Figures 1-4. This safe was constructed for a maximum of 250 millicuries of cobalt 60 and the occasional storage of isotopes of low activity, such as iodine 131, gold 198, and phosphorus 32. The storage cavity is $4 \times 8 \times 4$ inches deep, with a minimum of 4 inches of lead at the sides, bottom, and top.

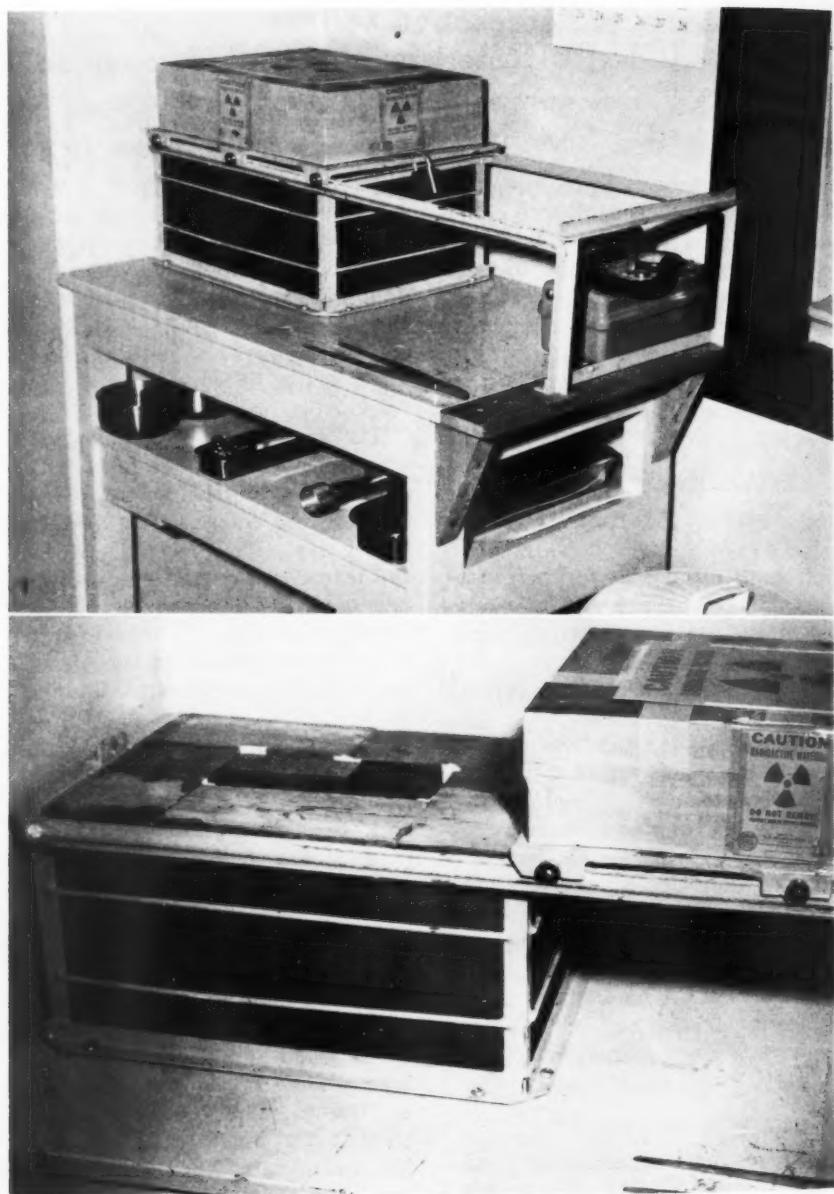
¹ Accepted for publication in January 1960.

Standard lead bricks, $2 \times 4 \times 8$ inches, were stacked so that it was not necessary to cut any of them and, after assembly, were forced into close contact. This was done by driving thin layers of Masonite between the bricks and the steel frame, but could have been accomplished by hammering a piece of wood placed against the bricks at appropriate points.

The sheet of steel supporting the top was designed to be slightly higher from the table than the height of the bricks forming the walls. Thin sheets of cardboard were then placed in the bottom of the frame and a trial stack of bricks reassembled until the top surface of the wall began to engage the sheet of steel. A close approximation of the walls and the top was then obtained by filing away the bricks.

The top is made of 12 bricks and weighs about 300 pounds. The ball-bearing rollers supporting the top are each 300 pounds test, permitting a weight of up to 1,800 pounds, if necessary.

Security: Locking of the safe is provided for by a steel pin welded to the sheet of steel supporting the top. This pin engages a hole in the frame when the top is closed, as shown at H in Figure 3. When a padlock is fastened through the holes in the other end of the steel plate and the frame, the top is completely locked to the frame. The frame is welded together, so that it is impossible to disassemble the brick structure, and is securely fastened to the supporting table with large screws. If desirable, the frame can be welded to another sheet of steel underneath instead of being fastened directly to the table. In the safe described, the bricks comprising the top are taped together and maintain position by friction. However, as shown by the dotted lines in Figure 3, the top bricks can be enclosed in a steel frame



Figs. 1 and 2. Storage safe for radioactive materials, closed and open.

which would prevent their removal for any reason.

Adaptability: This type of safe can be constructed with wall thicknesses of 2, 4, 6, 8, or 10 inches of lead, depending on individual requirements, with standard

$2 \times 4 \times 8$ inch bricks. If the amount of radioactivity is such that division of the material is not desired, the safe can be built on a mobile cart (see above). The size and shape of the storage cavity can be varied to meet individual requirements.

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Legend :

- A - Standard 2" x 4" x 8" Lead Bricks
- B - $\frac{1}{2}$ " Angle iron - All Framework
- C - $\frac{1}{4}$ " Steel Plate
- D - $\frac{3}{4}$ " Wheels
- E - $\frac{1}{2}$ " x $\frac{1}{8}$ " Steel Strap
- F - $\frac{1}{8}$ " Rods
- G - $\frac{1}{4}$ " Masonite
- H - Hole To Engage Pin
- I - Hole For Lock

Note

Dotted Lines
Indicate Proposed
Framework Of
 $\frac{1}{2}$ " Angle iron

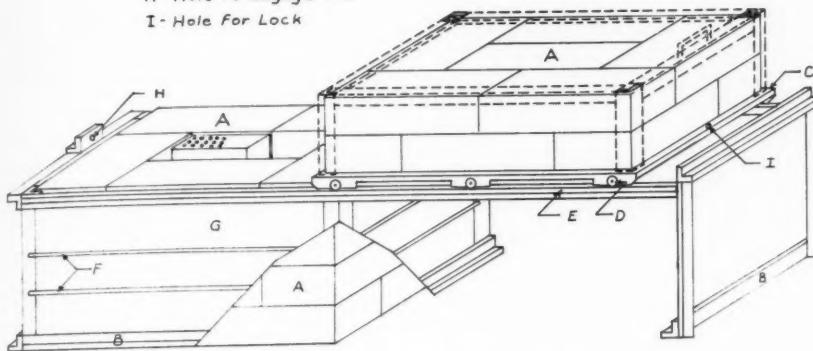


Fig. 3. Storage safe construction details.

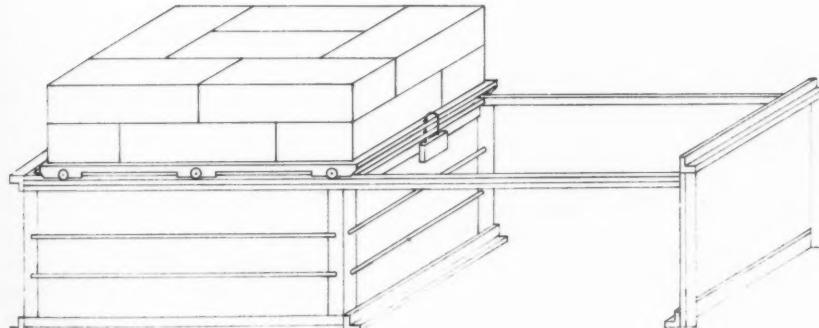


Fig. 4. Storage safe closed and locked.

The safe can be disassembled for moving, an obvious advantage over a solid structure weighing more than 800 pounds.

Economy: The supporting table has a heavy wood frame. Besides the lead bricks, the safe is constructed of common angle-iron, steel bar, sheet steel, and common ball-bearing rollers. Lead bricks may be obtained from the National Lead Company² or from other suppliers, for approximately \$5.50 each, plus shipping cost.

The safe shown required 34 bricks, 2 X 4 X 8 inches. The table and the steel structure can be constructed by ordinary maintenance personnel of almost any hospital for less than \$100 including labor.

Efficiency: The top of the safe rolls easily, since the ball-bearing rollers move smoothly on the angle-iron surfaces. A stop is provided to prevent the top from rolling off onto the floor. A handle may be provided on the steel frame, as shown by dotted lines in Figure 3. The amount of protection is sufficient to permit placing

²722 Chestnut Street, St. Louis, Mo.

Legend:

- A - Standard 2" x 4" x 8" Lead Bricks
- B - 2" x 6" Wood
- C - $\frac{1}{2}$ " Steel Plate
- D - 2" Angle iron - All Frame work
- E - 1" x $\frac{1}{8}$ " Angle iron
- F - $\frac{1}{4}$ " Plywood
- G - $\frac{1}{4}$ " x 4" Strap

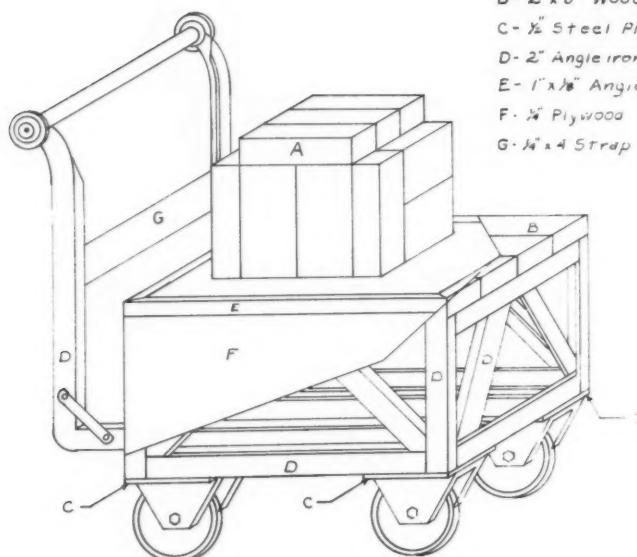


Fig. 5. Construction of transport cart for radioactive materials.

the loading bench very near the safe, thus minimizing the time during which the radioactive materials are not behind barriers.

Individual Source Housing: The principal purpose for which this safe was constructed was for storing small wires of cobalt 60 and needles containing low-intensity sources of this same isotope. Routine counts of these sources are made regularly. A portion of a lead brick was drilled with holes of appropriate size, length, and number so that each source is housed in a single hole (Fig. 2). The holes are countersunk so that the entire source is within the brick, yet each source is easily picked up with forceps. This arrangement permits rapid counting and easy removal and replacement of the sources without unnecessary handling. Counting is rapid, since usually only the empty holes need be counted.

The brick provides an additional barrier. Empty lead shipping containers are stacked in front of the safe (Fig. 6), further reducing the radiation flux at the point occupied by the technician. With 240

millicuries of cobalt 60 in the safe, the radiation intensity at the position of the technician is less than 0.2 milliroentgens per hour.

CART FOR TRANSPORTING RADIOACTIVE MATERIALS

The cart illustrated in Figures 5 and 6 was constructed to provide barrier protection while moving cobalt-60 intracavitary devices and needles to the operating room and returning them after removal from patients.

The cart has a heavy steel frame, as shown. The rubber-covered bumpers are designed to protect doors and walls. The rubber tired wheels are 7 inches in diameter to roll easily across small irregularities in the floor and into elevators. The rear casters are free-turning on ball bearings. The rear wheels on the cart illustrated are mounted too far forward and the cart, with a relatively small load of lead bricks, has a tendency to tip over when pulled backward into an elevator. The rear casters should be mounted on an extension of the frame so that the centers of the

wheels are definitely behind the main body of the cart.

The protection provided can be varied according to individual need. The cart can be drawn up close to the loading bench and storage safe, minimizing the time during which activity is not behind barriers.

Figure 6 shows the relative position of these units in the radioactive isotopes storage room.

SUMMARY

Designs for practical radioactive materials storage safe and transport cart have been described.

Suite 2-A, 1501 Arizona Ave.
El Paso, Texas



Fig. 6. Location of safe and transport cart in radioisotope storage room.

SUMMARIO IN INTERLINGUA

Dispositivos de Magasinage pro Materiales Radioactive: Mobiliario Practic de Construction "Domestic"

Es describete un tresor disponite particularmente pro le magasinage de 250 millicuries de cobalt-60 sed adaptabile etiam a altere requerimentos. Illo es construite ex blocos standard de plumbo, ordinari ferro angulate, barras e plattas de

aciiero, e rotettas a cossinettos de ballas.

Es etiam describete un carro construite a provider un barriera de protection durante le transporto de agulias e dispositivos pro le application intracavitari de cobalt-60 ad e ab le sala de operation.



EDITORIAL

The Uses of Fluoroscopy

For quite a long time the physicists have been pointing their thimbles at our fluoroscopes and making low, clucking noises of consternation and reproach. Our attention has been directed to the tube-table distance (too short), the added filtration (too little), and the shutters (far, far too eccentric). Disquieting leaks have come to light in the bilge, through which cataracts of charged particles (or electromagnetic waves) have been pouring, for who knows how long? Now, at the peak of the alert, as we trudge to the market for caulking, abandoned mines come to life in Leadville and Andalusia.

It is hard to imagine how anything but good can come of these inspections and safety precautions which have been so long due, and which will deliver our patients and ourselves from a bland poison with a long memory. Many fluoroscopes—too many—are deadly junk, peddled at a quick profit to dealer and operator. Almost anyone can buy one. Bargains are currently being advertised in Philadelphia for \$245.00 and up, complete with a handy milliampere switch, cardboard shutters, and a fluorescent image as bright as the moon. We nominate this hardware for oblivion, and with it such related hocus-pocus as fluoroscopic shoe-fitting, whole-body irradiation by zealous pediatricians, fracture reduction under roentgen observation, and the ritualistic peep at the heart and lungs that is so often tossed in with a general physical examination. The latter, an imposing and unfortunately common practice, usually establishes two truths that should require no confirmation: (1) the examiner is a man of science and (2) the patient's heart is beating. These are primitive practices. We outgrew them long ago,

and we can do very well without them.

Now perhaps it is time to consider another danger—the danger of panic. In our concern for radiation protection many of us have developed a morbid distrust of the fluoroscope which has been, for years, a most faithful and reliable instrument. Even now, after long acquaintance, we cannot approach it without a strong feeling of awe. For here is a machine with an eye for motion, *i.e.*, for life. If we try to put it aside we lose the pulse of our patients and soon become simple curators of anatomical prints—wholly safe and wholly useless. Since we cannot practice without the fluoroscope, we must study to use it with speed, skill, and a clear understanding of what one can and cannot do with it.

Almost everything worth knowing about the theory and mechanics of fluoroscopy was described in 1935 by Dr. Percy Brown and in 1942 by Dr. Edward Chamberlain in his Carman Lecture. Anyone reading these reports will be impressed by the patience and ingenuity of the authors, and by their great thoroughness in exploring the physical nature of roentgenoscopy. Particularly instructive are their comments, based on many measurements, concerning the limitations of even the well adapted retina in the dim light of the darkroom. But like so many others, they have very little to say about one characteristic of the fluoroscope that is so obvious that we often forget about it—its great versatility. Consider, for example, the problems that come within its range in a single day. Is the diaphragm paralyzed? Is the pylorus obstructed? Do the vocal cords move? Is there a hilar dance? Does either lung trap air? Is the mitral valve calcified? Where is the

tip of the cardiac catheter? Is there a block in the subarachnoid space? Are there esophageal varices? Is obstruction due to intussusception? We doubt that any other instrument, or combination, can answer as many critical questions as these with the speed, ease, and accuracy of the fluoroscope.

Animation is no substitute for detail. The fluoroscopic image is faint and fleeting, and most of us have missed mediastinal tumors as big as oranges, even when we were looking for them. This is true even with image amplification by electronic devices. A film is a document. A fluoroscopic observation is one man's impression until it has been recorded on film. We still rely on the radiograph for the diagnosis, but the impression often leads the way. The two complement each other; they cannot be interchanged. To search for static lesions with the fluoroscope, such as fractures, sinusitis, cavitary and minimal lung lesions, is to abuse a sharp tool and needlessly assault a patient.

The fluoroscope, traditionally, has had one great virtue. It has required the radiologist to come into the presence of the patient. This may not always be so, and before long we may scrutinize the apex beat from our armchairs through a closed circuit. "Please turn a bit more to the left, Miss Jones, wherever you may be." But for the time being, the act of fluoroscopy still requires the meeting of two people, and it is filled with the mystery of any dark encounter. There are few situations as dramatic in all of Medicine, a matter commonly understood by cartoonists but seldom by the novelist, poet, or choreographer. All the trappings are theatrical—the gloom, the eerie light, the couch that rises and subsides at a touch, and the figure, mute, as a rule, who materializes in armour, gauntlets, and a crimson mask. Not long ago there was ozone, for good measure, and a lively halo around the cables that took a human sacrifice, now and then.

Much has been written about the effect of fluoroscopy on the skin, spleen, and

bone marrow, but surprisingly little about its effects on the spirit. From the patient's point of view a fluoroscopic examination is a weird experience, especially the first time, and especially for a child. We will do well to remember that there is as much magic as fear in it and, for a moment, it gives a doctor extraordinary opportunities to understand and cheer a patient while armed with a certain mystery and power. Many doctors who are not radiologists know this and take advantage of it. Even before darkening the room we see the patient in a new light, a red light, and this is a peculiarly disarming color. It so strips away cosmetics and dulls the highlights of complexion that the fluoroscopist may see, if he will, the modeling of a patient's face and the bony foundations of expression long before he turns on his machine. There are many surprises—character beneath plainness, and resolution behind a sallow skin.

It seldom occurs to us to say a word about our goggles to patients, and for this reason they are forced to the most whimsical explanations for the disguise. A great many of them honestly believe that radiologists wear red glasses because they have weak eyes. This is not always true, of course, though it may be as hard to convince the patient as the clinician to the contrary. Many patients suppose that goggles are worn to protect the eyes from certain baneful, lingering effects that they were reading about, only yesterday, in the *Reader's Digest*. Others, when pressed, confess that they always thought that goggles gave the eyes a certain unnatural, penetrating power—spectral bifocals—as it were.

It is a small courtesy, but appreciated beyond words, for the radiologist to lift his visor when first meeting a patient, even for a moment, to allow himself to be recognized. This gesture is as old as King Arthur, and any effect it may have on accommodation is outweighed by the quick link it establishes between someone afraid and someone interested.

When the lights are turned off the fluoro-

scopist may be struck by certain changes in his subject. The patient is suddenly obliged to adapt, not only visually, but in all his other senses as well. More than once a positive Romberg sign was first elicited at the beginning of fluoroscopy, sometimes with a lacerated scalp as evidence. Relative deafness is common during sudden darkness; the fluoroscopist usually finds that he must raise his voice, in the dark minutes he sometimes wonders how many people read lips without ever knowing how much they depend on the habit. He may notice, too, that when the initial fear of a strange experience has subsided, many patients relax in a dark room, as they may not in a lighted examining room, and converse freely and with no self-consciousness, as though they were talking to themselves.

There are few references in the literature to fluoroscopic catalepsy, but it exists, and it is common. In the dark, many patients seem to forget where their extremities are. They will maintain any position in which they are placed for a long time, and without apparent fatigue. After drinking a cupful of barium, and then giving up the cup, they will often maintain the left hand at shoulder height until told to lower it.

Early in a fluoroscopic examination an unusual situation exists, during which a physician may make useful observations. He has the chance to study a patient's face secretly; the patient, who can see nothing, forgets that his own expression can be clearly recognized. Discrepancies between statements and facial expressions are not at all uncommon. The wince and grimace when the duodenum is pressed, followed by the flat assertion that there is no pain at all. Or a smile, during a vivid description of intense pain. There are other inconsistencies—a racing heartbeat under a guise of poise and geniality, or a courtly apology for the monstrous belch that was first seen by the fluoroscopist, some moments before, as a gasping swallow.

An occasional glimpse at the patient's

face will help to avert a fairly frequent complication of fluoroscopy: fainting. This may happen without warning, but often, before the knees buckle, the patient's hand will go to his forehead, and his head hang to one side. If the table does not go down quickly, he will. Fainting is sometimes predictable. It comes naturally with fear, hunger, and hypoglycemia. It is often associated with waiting, and with pylorospasm. It may be expected when an anxious individual has stood for a long time in the right anterior oblique position, as the observer thinks his thoughts and awaits the first glimpse of the duodenal cap. Frequently the duodenum will fill the moment the patient is asked to turn to the right, a maneuver that seems to relieve suspense.

On a wall in a sunless corridor at Cornell Medical College, facing an elevator that never arrives, anyone waiting may discover a strange display of 21 pieces of framed toilet paper, bearing neat, curved inscriptions resembling chromosomes or Burmese inventories. In a fine hand, on these fluoroscopic tracings, Walter B. Cannon, then a first-year medical student at Harvard, wrote, "Small cat looks weak and anemic" and "cat moribund when fed," and "cat died just after this tracing was made." In these simple sketches of the intestinal tracts of cats fed crackers and bismuth, a number of basic concepts of intestinal physiology were first defined. It was through the fluoroscope, in 1897, that Dr. Cannon first beheld "the wisdom of the body" that was to entrance him for the rest of his life. From his observations on the effects of fear, rage, and excitement on the stomach of the cat, a number of other experiments were devised, both radiological and nonradiological, that added to our knowledge of the relationship of the body and its emotions. The fluoroscopist peers at the central nervous system through his particular fundus oculi, the pyloric ring, a structure he will approach with great respect, for indifference to it can complicate his job immeasurably. If he is wise, he will spare his patient

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chatter on two subjects until he has seen all he cares to of the duodenum—The Job and The Family. If he keeps the patient waiting he may be sure that the patient will keep him waiting, and as he sits in the dark, giving the pylorus time to relax, a man of speculative turn of mind may wonder what dreams, fantasies, and enmities are having their say before him. On one occasion a fluoroscopist faced five consecutive patients with deep and uncompromising pylorospasm and was surprised when the sixth, a Venezuelan, appeared with a pyloric canal as relaxed as a May morning. He soon learned that when the six patients entered the waiting room, one of them had announced, in a loud voice, and to no one in particular: "They did this to mother two years ago, and she was never the same after her operation." The Venezuelan understood

only Spanish, and the Venezuelan got through first.

"In our study of Anatomy," wrote Sir Thomas Browne, "there is a mass of mysterious Philosophy, and such as reduced the very Heathens to Divinity . . ." If this could be true in the corruption of a 17th Century dissecting room should it, necessarily, be less true to the burnished and aseptic Heathens of today? With the constant restraint it requires and the instincts for protection, fluoroscopy—our new light—is giving us access, every day, to mysteries of which our fathers never dreamed. Through its cautious use we can all of us become better anatomists, better physicians and physiologists, and—who knows?—perhaps even philosophers as well.

JOHN McCLENAHAN, M.D.
Philadelphia, Penna.



RADIOLOGICAL SOCIETY OF NORTH AMERICA

FORTY-SIXTH ANNUAL MEETING: PRELIMINARY PROGRAM

Netherland-Hilton Hotel, Cincinnati, Ohio, December 4-9, 1960

Monday, December 5

OPENING SESSION: 1:45-4:20 P.M.

Caprice Pavilion

Call to Order. THEODORE J. WACHOWSKI, M.D., President.

Greetings. ROBERT E. HOWARD, M.D., President, Cincinnati Academy of Medicine

Cesare Gianturco, M.D., Urbana, Ill.
First Vice-President, Presiding

President's Address. THEODORE J. WACHOWSKI, M.D., Wheaton, Ill.

Memorial Fund Lecture: Radiation in Outer Space; Natural and Man-Made. PAYNE S. HARRIS, M.D., Los Alamos. Introduced by LEO G. RIGLER, M.D. Conventional Building Materials as Protective Radiation Barriers. E. DALE TROUT, D.Sc., JOHN P. KELLEY, B.S., ARTHUR C. LUCAS, B.S., Milwaukee, Wisc.

Patient Exposure in Diagnostic Radiology. RUSSELL H. MORGAN, M.D., JAMES M. MOZLEY, PH.D., EDWARD F. GEHRET, JR., Baltimore, Md.

Radiation Safety Program of the City of Philadelphia. JESSE LIEBERMAN, M.S., ROBERT O. GORSON, M.S., MARVIN GREEN, B.S., Philadelphia, Penna.

Legislative Aspects of Radiation. Speaker to be announced.

BUSINESS MEETING: 4:30 P.M.

Caprice Pavilion

Tuesday, December 6

DIAGNOSIS: 10:30 A.M.-12:30 P.M.

Caprice Pavilion

Ted F. Leigh, M.D., Atlanta, Ga.
Second Vice-President, Presiding

Panel on Gastrointestinal Diseases. Moderator, RICHARD H. MARSHAK, M.D., New York, N. Y. Members: RICHARD SCHATZKI, M.D., Boston, Mass., BERNARD S. WOLF, M.D., New York, WILLIAM B. SEAMAN, M.D., New York.

Radiological Diagnosis of Polyps of the Colon in Children. DOUGLAS W. MACEWAN, M.D., and J. SCOTT DUNBAR, M.D., Montreal, Quebec.

Antral Deformity Due to Perigastric Adhesions or Bands Simulating Carcinoma of Stomach. ABRAHAM GEFFEN, M.D., and FRIEDA FELDMAN, M.D., New York, N. Y.

The Differential Diagnosis of Benign and Malignant Gastric Ulcers. GERALD D. DODD, M.D., and ROBERT NELSON, M.D., Houston, Texas.

RADIOBIOLOGY: 10:30 A.M.-12:35 P.M.
Caprice Suite

John W. Clark, M.D., Chicago, Ill., Presiding

Radiation Effects on Skin and Subcutaneous Tissue: A Quantitative Study of Collagen Content; Modification with T-3. ARVIN S. GLICKSMAN, M.D., TOSHIO KITAGAWA, M.D., J. J. NICKSON, M.D., New York, N. Y.

The Effect of Oxygen on the Rate of Inactivation of *Escherichia coli* by Incorporated Radioactive Phosphorus. JAMES G. VAN DYKE, M.D., New York, N. Y.

The Oxygen Effect: Quantitative Tumor Cell Survival-Dose Relationships in a Mammalian System. J. ROBERT ANDREWS, M.D., Bethesda, Md.

The Effect of Radiation on Mammalian Peripheral Nerve. MARY C. ARNOLD, FRANK HARRISON, FREDERICK J. BONTE, M.D., Dallas, Texas.

Strontium-90 Induced Osteosarcomas Studied by Serial Roentgenography. MIRIAM P. FINKEL, Ph.D., BIRUTE O. BISKIS, M.D., PATRICIA J. BERGSTRAND, B.S., Argonne, Ill.

Life Shortening in Mice Irradiated with Either Fission Neutrons or Cobalt-60 Gamma Rays. HOWARD H. VOGEL, JR., PH.D., NORMAN A. FIRGERIO, PH.D., DONN L. JORDAN, B.S., Argonne, Ill.

Some Aspects of the Microcirculation of a Transplantable Experimental Tumor. MORTON M. KLIGERMAN, M.D., and DORA KYRYK, B.A., New Haven, Conn.

DIAGNOSIS: 2:00-4:15 P.M.

Caprice Pavilion

Justin E. McCarthy, M.D., Cincinnati, Ohio
Chairman, Local Committees, Presiding

The Differential Diagnosis of Extramedullary, Intradural, and Extradural Spinal Canal Lesions. JEROME H. SHAPIRO, M.D., MICHAEL OCH, M.D., HAROLD G. JACOBSON, M.D., New York, N. Y.

The Significance of Minimal Myelographic Deformities in Patients with Symptomatic Lumbar Disk Protrusions. SIDNEY P. TRAUB, M.D., Saskatoon, Saskatchewan.

The Importance of Cervical Myelography in Cervical and Upper Thoracic Nerve Root Avulsion. WILLIAM J. VARLEY, M.D., and CHARLES R. PERRYMAN, M.D., Pittsburgh, Penna.

The Diagnosis of Lesions in the Basilar Artery, Pons, and Cerebellum by High Cervical Myelography. HARRY Z. MELLINS, M.D., Brooklyn, N. Y.

New Technic for Accurately Projecting the Dorsum Sellae into the Foramen Magnum. LEWIS E. ETTER, M.D., Pittsburgh, Penna.

Radiologic Considerations of the Perinatal Distress Syndrome. EDWARD B. SINGLETON, M.D., Houston, Texas.

Tracheomalacia and Tracheal Collapse in Infancy. J. SCOTT DUNBAR, M.D., Montreal, Quebec.

THERAPY: 2:00-4:10 P.M.

Caprice Suite

Roger A. Harvey, M.D., Chicago, Ill., Presiding

Clinical Experiences with an "After Loading" Applicator in the Treatment of Uterine Carcinoma. U. K. HENSCHKE, M.D., B. S. HILARIS, M.D., EDWARD HOLODNY, ROSS GARRETT, New York, N. Y.

Post Irradiation Hysterectomy for Endometrial Carcinoma. Early or Delayed? RIEVA ROSH, M.D., and WAYNE H. DECKER, M.D., New York, N. Y.

Interstitial Radiation Therapy: Use of After Loading Technic with Ir¹⁹² Wires. HERMAN D. SUIT, M.D., E. B. MOORE, M.D., ROBERT SHALEK, PH.D., M.D., Houston, Texas, and J. ROBERT ANDREWS, M.D., Bethesda, Md.

Interstitial Radium Implantation by Means of a New Catheter Technic. JOSEPH E. SCALLON, M.D., Torrance, Calif.

Experience with Radioactive Tantalum Wire as a Source for Interstitial Therapy. W. E. C. ALLT, M.D., J. W. HUNT, M.A., PH.D., W. D. RIDER, M.D., Toronto, Ontario.

Radiation Therapy with a 10-50 Mev Scattered Electron Beam. II. Clinical Experience and Considerations. L. M. ZATZ, M.D., C. VON ESSEN, M.D., H. S. KAPLAN, M.D., Palo Alto, Calif.

Carcinoma Simplex of the Thyroid: Results of 2-Mev X-ray Therapy. MAGNUS I. SMEDAL, M.D., Boston, Mass.

Chemical Modifiers of Radiation Response of Tissue: The Effects of These Compounds on the Radiation Effect. MELVIN L. GRIEM, M.D., Chicago, Ill.

BUSINESS MEETING: 4:30 P.M.

Caprice Pavilion

Wednesday, December 7

DIAGNOSIS: 10:30 A.M.-12:30 P.M.

Caprice Pavilion

Harold G. Reineke, M.D., Cincinnati, Ohio, Presiding

Cardiac Laminography. KENNETH D. McGINNIS, M.D., Lexington, Ky., WILLIAM R. EYLER, M.D., and H. ALVAREZ, M.D., Detroit, Mich.

Pulmonary Venous Changes in Congenital Heart Disease in Adults. ROBERT S. ORMOND, M.D., ANDREW K. POZNANSKI, M.D., ARCH W. TEMPLETON, M.D., Detroit, Mich.

An Evaluation of Cardiovascular Contrast Media. J. STAUFFER LEHMAN, M.D., and JOSEPH N. DEBBAS, M.D., Philadelphia, Penna.

The Angiographic Investigation of Cerebrovascular Insufficiency. HILLIER L. BAKER, JR., M.D., Rochester, Minn.

Radiographic Evaluation of the Great Vessels by Intravenous Aortography. JAMES H. SCATLIFF, M.D., and RICHARD H. GREENSPAN, M.D., New Haven, Conn.

Forward Aortography. WILLIAM V. WELDON, M.D., and LONGSTREET C. HAMILTON, M.D., Washington, D. C.

A Patient Propulsion Procedure for Aorto-Arteriography. RUSSELL WIGH, M.D., WILLIAM F. LINDSEY, M.D., JACK MORGAN, B.S., W. H. POOL, M.D., Augusta, Ga.

Safety of Mesenteric Arteriography (A Comparative Experimental Study on Dogs). TED L. GRAYSON, M.D., ALEXANDER R. MARGULIS, M.D., PETER HEINBECKER, M.D., St. Louis, Mo.

ISOTOPES: 10:30 A.M.-12:30 P.M.

Caprice Suite

Hymer L. Friedell, M.D., Cleveland, Ohio, Presiding

Usefulness of Plasma I¹³¹ Determinations in the Diagnosis of Hyperthyroidism "Problem" Cases. A. RAVENTOS, M.D., ROBERT O. GORSON, M.S., and RICHARD H. CHAMBERLAIN, M.D., Philadelphia. Localizing the Placenta with Radioactive Iodinated Human Serum Albumin. F. C. HEAGY, M.D., Ph.D., and D. P. SWARTZ, M.D., London, Ontario.

Comparison of Radioisotope Scanning with Cerebral Arteriography and Air Studies in Brain Tumor Localization. JOHN G. McAfee, M.D., and DAVID R. TAXDAL, M.D., Baltimore, Md.

Dissociation Studies of Renal Function with Radioactive Tagged Compounds. I. MESCHAN, M.D., JOSEPH E. WHITLEY, M.D., R. L. WITCOFSKI, M.D., T. A. HOSICK, J. FELTS, M.D., Winston-Salem, N. C.

P³² Intraocular Uptake Study in the Differential Diagnosis of Intraocular Tumors: Technics and Radiation Considerations. DAVID TABOWITZ, A.B., and BERNARD GOLDBERG, M.D., New York, N. Y.

Labeling Pharmaceutical Compounds by Neutron Bombardment. L. R. JAMES, M.D., R. E. OGBORN, M.D., G. JOHNSON, M.D., Omaha, Nebr.

DIAGNOSIS: 2:00-4:25 P.M.

Caprice Pavilion

Benjamin Felson, M.D., Cincinnati, Ohio, Presiding

Self-Limiting, Infantile, Non-specific Spondylitis. ROBERT C. JAMISON, M.D., ERNEST M. HEIMLICH, M.D., BERNARD J. O'LOUGHLIN, M.D., Los Angeles, Calif.

Bone Changes in Cushing's Syndrome and Steroid Therapy. RONALD O. MURRAY, M.D., London, England.

The Effect of Irradiation on Growing Bone. HOWARD J. BARNHARD, M.D., ROBERT W. GEYER, M.D., Little Rock, Ark., LEONARD STANTON, M.S., Philadelphia, Penna.

Myelofibrosis. WILLIAM T. MESZAROS, M.D., and MELVIN SISSON, M.D., Chicago, Ill.

Characteristic Bone Lesions in Post-Irradiated Carcinoma of the Cervix. PHILIP RUBIN, M.D., and D. PRABHASAWAT, M.D., Rochester, N. Y.

Laminography as a Method of Evaluation of Correct Reduction of the Congenitally Dislocated Hip. WILLIAM S. ALTMAN, M.D., Quincy, Mass., and V. MORACE, Naples, Italy.

PHYSICS: WORK IN PROGRESS: 2:00-4:30 P.M.
Caprice Suite

Warren K. Sinclair, Ph.D., Argonne, Ill., Presiding

This program is arranged only a few weeks before the meeting, and details are not now available.

Thursday, December 8

DIAGNOSIS: 10:30 A.M.-12:35 P.M.

Caprice Pavilion

Archie Fine, M.D., Cincinnati, Ohio, Presiding

The Lower Urinary Tract in Infants and Children. LAWRENCE A. DAVIS, M.D., ROBERT LICH, JR., M.D., LONNIE W. HOWERTON, M.D., WILLIAM JOULE, M.D., Louisville, Ky.

Cineurethrogram and Voiding Cinecystography, with Special Attention to Vesicoureteral Reflux. KENNETH E. GROSS, M.D., and STEVENS S. SANDERSON, M.D., Tacoma, Wash.

Evaluation of Film Size in Cineradiography. JOHN A. CAMPBELL, M.D., and EUGENE C. KLATTE, M.D., Indianapolis, Ind.

Percutaneous Transfemoral Renal Angiography in Hypertension. MORDECAI HALPERN, M.D., NATHANIEL FINBY, M.D., JOHN A. EVANS, M.D., New York, N. Y.

A Comparative Experimental Approach to Contrast Materials in Renal Angiography. SAM E. MORRIS, M.B., B.S., ELLIOTT C. LASER, M.D., BERNARD FISHER, M.D., SIL H. LEE, M.D., and RICHARD C. GRANKE, B.S., Pittsburgh, Penna.

Medullary "Sponge" Kidney. A. J. PALUBINSKAS, M.D., San Francisco, Calif.

PHYSICS: 10:30 A.M.-12:30 P.M.

Caprice Suite

John S. Laughlin, Ph.D., New York, N. Y., Presiding

Dose Measurements Close to Discrete Radium and Cobalt-60 Sources. MILTON FRIEDMAN, M.D., MORRIS HADARA, M.S., GERALD J. HINE, Ph.D., New York, N. Y.

Dose Distributions in a Multiple Source Radiation Chamber. M. L. JACOBS, M.D., and L. PAPE, M.Sc., Duarte, Calif.

Cobalt-60 Isodose Curves Showing Displacement of the Center of Rotation Dose from the Center of Rotation for 240° Rotation. LILLIAN E. JACOBSON, M.A., GEORGE P. KOECK, M.D., WILLIAM R. HILLSINGER, B.S., MARK E. SCHWARZ, B.A., Newark, N. J.

Determination of Isodose Curves for Supervoltage and Cobalt-60 Teletherapy Machines Using X-ray Film. LEONARD STANTON, M.S., Philadelphia, Penna.

On the Use of Thimble Chambers in Phantoms. GAIL D. ADAMS, Ph.D., San Francisco, Calif.

Bone-Marrow Dose Produced by Radioactive Isotopes. EDWARD HOLODNY, H. LECHTMAN, and JOHN S. LAUGHLIN, Ph.D., New York, N. Y.

DIAGNOSIS: 2:00-4:25 P.M.

Caprice Pavilion

Henry Snow, M.D., Dayton, Ohio, Presiding

Lymphangioma in the Lymphedematous Arm After Mastectomy. GEORGE P. KEEFER, M.D., and JACOB H. VASTINE, 2ND, M.D., Philadelphia, Penna. Lymphangiograms: Their Diagnostic and Therapeutic Potential. SIDNEY WALLACE, M.D., LAIRD G. JACKSON, M.D., BURTON SCHAFER, M.D., JOHN GOULD, M.D., ARTHUR WEISS, M.D., SIMON KRAMER M.D., Philadelphia, Penna.

Pneumatosis Intestinalis. WALTER S. KEYTING, M.D., ALVIN L. DAYWITT, M.D., ROBERT R. MCCARVER, M.D., Denver, Colo.

Diagnostic Pneumomediastinum. DIXON L. HUGHES, M.D., WILLIAM HANAFEE, M.D., BERNARD J. O'LOUGHLIN, M.D., Los Angeles, Calif.

Laceration of the Liver. JAMES J. MCCORT, M.D., San Jose, Calif.

Incidence of Esophageal Webs in the Post Cricoid Area in a General Radiological Practice, with Notes as to Associated Diseases. J. L. MORTON, M.D., Indianapolis, Ind.

An Evaluation of Copper Filtration in Radiography. RALPH M. ADAMS and WALTER L. STILSON, M.D., Los Angeles, Calif.

Measurement of Bone Marrow and Gonadal Dose from the Chest X-ray Examination as a Function of Field Size, Field Angulation, Tube Kilovoltage and Added Filtration. E. R. EPP, M.D., H. WEISS, M.D., JOHN S. LAUGHLIN, Ph.D., R. S. SHERMAN, M.D., New York, N. Y.

THERAPY: 2:00-4:00 P.M.

Caprice Suite

Juan del Regato, M.D., Colorado Springs, Colo.
Third Vice-President, Presiding

Treatment of Carcinoma of the Breast. Five-Year Study of Simple Mastectomy Followed by Post-operative Roentgen Therapy. FREDERICK W. O'BRIEN, JR., M.D., Cleveland, Ohio.

The Effects of Intensive Irradiation of the Human Heart. J. M. VAETH, M.D., L. Z. FEIGENBAUM, M.D., M. D. MERRILL, M.D., San Francisco, Calif.

Carcinoma of the Breast Associated with Pregnancy. M. VERA PETERS, M.D., Toronto, Ontario.

Radioactive Phosphorus in the Treatment of Wide-spread Bone Metastases from Breast Carcinoma. J. P. STORAASLI, M.D., R. L. KING, M.D., H. KRIEGER, M.D., HYMER L. FRIEDELL, M.D., Cleveland, Ohio.

Preoperative Treatment of Adenocarcinoma of the Rectum. ROBERT H. LEAMING, M.D., New York, N. Y. The Treatment of Epidermoid Carcinoma of the Anus. T. W. WATSON, M.B., Saskatoon, Saskatchewan.

Radiotherapy in Carcinoma of the Bladder: Possible Complications and Their Prevention. FERNANDO G. BLOEDORN, M.D., RAUL MERCADO, JR., M.D., CARLO A. CUCCIA, M.D., JOHN D. YOUNG, M.D., Baltimore, Md.

Dosage to the Gonads During Radiation Therapy for Benign Conditions. GUSTAVE KAPLAN, M.D., CARL COLLICA, B.S., SIDNEY RUBENFELD, M.D., New York, N. Y.

PHYSICS: 2:00 P.M.-4:00 P.M.

Private Rooms, A, B, C, D

Carl B. Braestrup, A.B., New York, N. Y., Presiding

Absorbed Dose Determination for Scanning Electron Beams. LAWRENCE H. LANZL, Ph.D., LESTER S. SKAGGS, Ph.D., MARTIN L. ROZENFELD, Chicago, Ill. Radiation Therapy with a 10-50 Mev Electron Beam. I. Physical Considerations. R. LOEVINGER, Ph.D., C. J. KARZMARK, Ph.D., M. WEISSBLUTH, Ph.D., Palo Alto, Calif.

Medical Reactor Neutron Spectroscopy. CHARLES G. AMATO, Upton, L. I., N. Y.

Performance Studies with Fluoroscopic Systems, Including Image Intensification and Television Pick-up. EDWARD W. WEBSTER, Ph.D., Boston, Mass.

The Measurement of Absorbed Dose Adjacent to Radioactive Sources by Chemical Dosimetry. SHIR-

LEY D. VICKERS, NATHANIEL F. BARR, JOHN S. LAUGHLIN, Ph.D., New York, N. Y.

Re-Evaluation of Radiation Dose Due to Fall-out. PHILIP F. GUSTAFSON, Ph.D., and MICHAEL A. KERRIGAN, B.S., Argonne, Ill.

BUSINESS MEETING: 4:30 P.M.

Caprice Pavilion

THE CARMAN LECTURE: 8:30 P.M.

Caprice Pavilion

Theodore J. Wachowski, M.D., President, Presiding.

The Visualization of the Biliary Tract. WARREN H. COLE, M.D., Chicago, Ill.

Presentation of the Gold Medal of the Society.

Announcement of the Scientific Awards.

Introduction of New Officers.

Presentation of the Pfahler Gavel.

Friday, December 9

WORKS IN PROGRESS

10:30 A.M.-12:30 P.M.

Caprice Pavilion

This program is arranged only a few weeks before the meeting, and details are therefore not available for publication here.

WORKS IN PROGRESS

10:30 A.M.-12:30 P.M.

Caprice Suite

This program is arranged only a few weeks before the meeting, and details are therefore not available for publication here.



REFRESHER COURSES: POSTGRADUATE INSTRUCTION

The 1960 Refresher Course Series will be presented during the Forty-Sixth Annual Meeting of the Radiological Society of North America at the Netherland-Hilton Hotel, Cincinnati, Ohio. Registration for the meeting will begin at 1:00 P.M., Saturday, Dec. 3. On Sunday, Dec. 4, the registration desk will be open at 9:00 A.M., and Monday through Friday at 8:00 A.M. *Please register early.* The courses will start at 2:00 P.M., Sunday, Dec. 4, with the Therapy Information Session. This will be followed by a course on the legal control of radiation exposure beginning at 4:30 P.M., and the Film Reading Session at 7:30 P.M.

On Monday, Dec. 5, there will be a series of courses beginning at 8:30 A.M. and continuing until 10:00 A.M., with a second series of courses from 10:30 to 12:00 A.M. The remainder of the week the Refresher Course period will be from 8:30 to 10:30 A.M. No other meetings will be scheduled for these hours.

Attendance is limited to the medical profession, including graduate students and residents in radiology, radiation physicists, radiobiologists, chemists, **medical students certified by the deans of their respective medical schools**, and others closely allied with the science of radiology. **Residents, interns, and medical students will be limited to courses being presented in the Pavilion Caprice Room and the Continental Room.**

A registration fee of \$25, which includes the refresher course fee, must be paid by all nonmembers of the Radiological Society of North America at the time of registration. The exceptions are guest speakers, guest instructors, scientific exhibitors,

residents, or fellows in radiology, *medical students*, trainees in physics, and officers in the Armed Forces of the United States on temporary duty away from their practice. All must register at the registration desk. Payment of the registration fee by non-members is *not* to accompany the request for tickets, but is to be paid at the time of registration. All refresher course tickets will be held at the registration desk in the Netherland-Hilton Hotel. Please call for them there. Positive identification will be required from nonmembers and guests for admission to the Refresher Courses. If you cannot use the tickets you have reserved, please notify the Chairman of the Refresher Course Committee.

Admission to the courses will be by presentation of the registration badge and a ticket for the desired course, with the exception of Courses Nos. 1, 2, and 3 on Sunday. Admission to these three courses will be by badge only. No ticket is required.

Read the description of the courses, noting particularly the days on which they are to be given, and make your selection. Turn to the colored insert, and indicate thereon your first, second, and third choice for the day, and mail the request promptly. The number attending many courses is limited by the capacity of the rooms, and requests for tickets will be honored in the order in which they are received. You will be notified regarding your selection of courses.

We would appreciate suggestions for future courses, as well as new instructors for some of the present ones. Please put your suggestions on a card and leave it at the registration desk, or mail it directly to the Refresher Course Chairman.

Course No. 1: Sunday, 2:00-4:00 P.M.

Therapy Information Session

DONN G. MOSSER, M.D., Minneapolis, Minn.
Moderator

ORLISS WILDERMUTH, M.D., Seattle, Wash.
ROBERT J. BLOOR, M.D., Detroit, Mich.
ROBERT ROBBINS, M.D., Philadelphia, Penna.

A series of selected cases will be presented, showing the clinical course, pathology, and results. Only histologically proved cases will be used.

Course No. 2: Sunday, 4:30-5:30 P.M.

Current Developments in the Legal Control of Radiation Exposure

GEORGE T. FRAMPTON, Professor of Law, University of Illinois College of Law, Urbana, Ill.

Public policy problems in translating exposure standards into legal regulations and into legal

criteria for compensating persons "over-exposed," and in allocating among various governmental levels the responsibility for fixing and enforcing standards and administering compensation will be discussed. Discussion will be followed by a question and answer period.

Course No. 3: Sunday, 7:30-9:30 P.M.

Film Interpretation Session

BERNARD J. O'LOUGHLIN, M.D., Los Angeles, Calif.
Moderator

HARRY Z. MELLINS, M.D., New York, N.Y.
BENJAMIN FELSON, M.D., Cincinnati, Ohio
J. E. MILLER, M.D., Dallas, Texas

L. HENRY GARLAND, M.B., San Francisco, Calif.

This session is a diagnostic symposium based on proved cases. Every effort will be made to present cases that are of educational value, and that will permit an orderly, analytical approach to a diagnostic problem.

Any member of The Radiological Society of North America who wishes to present an instructive case may submit his material to the Moderator, Bernard J. O'Loughlin, M.D., University of California Medical Center, Los Angeles, Calif.

Course No. 4: Monday, 8:30-10:00 A.M.

Treatment Planning: X-rays of Conventional Energy

A. RAVENTOS, M.D., Philadelphia, Penna.
J. HALE, Ph.D., Philadelphia, Penna.

X-ray therapy equipment operating at 250 kvp or less is capable of producing quite satisfactory dosage distributions for the treatment of many lesions located deep within the body, as well as for practically all superficially placed lesions. Obtaining the optimum possible dosage distribution with conventional therapy equipment often requires careful planning, based upon a good practical knowledge of the physical principles involved.

The basic principles of treatment planning will be discussed from both the physical and clinical standpoints, with examples of the use of very low-energy, intermediate, and 250-kvp x-ray beams. Some of the methods that have proved useful for portal selection, localization, and beam direction will be illustrated.

Course No. 5: Monday, 8:30-10:00 A.M.

Practical Technics in Pediatric Radiology

LAWRENCE A. DAVIS, M.D., Louisville, Ky.

The various technics successfully used in radiography and fluoroscopy in children will be demonstrated and discussed. Stress will be placed on simplicity and radiation protection. The technics used in gastrointestinal examination, excretory urography, and cardiac fluoroscopy will be detailed.

Course No. 6: Monday, 8:30-10:00 A.M.

Therapeutic Applications of Radioactive Isotopes

E. R. KING, MC USN, Bethesda, Md.

In the early days of the evaluation of the medical uses of radioisotopes, a great hope was placed in the possible treatment of cancer by this form of radiation. Several years experience, however, has proved that the therapeutic applications of radioisotopes are limited, particularly in reference to cancer. This statement does not apply to radioisotopes used in brachytherapy and teletherapy, nor does the discussion to be given in this course concern these more specialized applications.

Routine uses of radioisotopes may be listed under three categories: (1) the treatment of hematological disorders, (2) the treatment of hyperthyroidism and certain carcinoma of the thyroid, and (3)

the treatment of effusions complicating malignant diseases.

In certain instances, studies have been made, and are still under way, which investigate the uses of newer isotopes in treating cancer. This discussion will cover the routine uses in some detail, with a brief discussion of some new approaches in radioisotope therapy.

Course No. 7: Monday, 8:30-10:00 A.M.

The Small Intestine

RICHARD H. MARSHAK, M.D., New York, N.Y.

Part I

1. Technic, including a discussion of the various barium preparations
2. Concepts of small intestinal patterns
3. The malabsorption syndrome. Sprue, lymphosarcoma, and Whipple's disease
4. Interpretation of functional changes
5. Barium studies in small intestine obstruction

Part II

1. Regional enteritis
2. Infarction of the small bowel
3. Tumors
4. Miscellaneous disorders including scleroderma, amyloidosis, allergy

(This course continued Wednesday, Course No. 43)

Course No. 8: Monday, 8:30-10:00 A.M.

Radiation and Chemicals: Time-Dose Responses with Two Modalities

SYDNEY F. THOMAS, M.D., Palo Alto, Calif.

A review of some basic time-dose radiation responses in the light of present day knowledge. Combinations of commonly used chemicals in sequence and singly in relation to radiation. Clinical and experimental approaches will be covered. Practical applications will be exemplified.

Course No. 9: Monday, 8:30-10:00 A.M.

Bronchography

WILLIAM MOLNAR, M.D., Columbus, Ohio

At the Ohio State University Hospital bronchography is accepted as the most reliable single procedure in the diagnosis and localization of endobronchial diseases. After acquiring some experience with the method, it can be made simple enough to be practical in everyday diagnostic problems. Detailed discussion of a simple bronchographic technic will be presented following demonstrations of the normal anatomy and variations of the bronchial tree. Bronchographic findings in pulmonary emphysema, chronic bronchitis, bronchiectasis, and in cases with carcinoma of the lung will be discussed. There will be special emphasis on

differential diagnosis between benign and malignant endobronchial lesions. The clinical material presented in this course has been selected from more than 3,000 bronchographic examinations.

Course No. 10: Monday, 8:30-10:00 A.M.

Recent Developments in Radiation Biology

T. C. EVANS, Ph.D., Iowa City, Iowa

Basic considerations in Radiobiology will be reviewed, with the ascites tumor cell as the illustrative material.

Recent literature in Radiobiology will be summarized to include the following topics: the oxygen effect; protection, treatment; direct and indirect effects; radiomimetic substances; late effects; and effects on nucleoprotein synthesis using labeled precursors as a method of study.

Course No. 11: Monday, 8:30-10:00 A.M.

Male Cystourethrography

NATHANIEL FINBY, M.D., New York, N. Y.

Methods and technics of cystourethrography will be presented, with a demonstration of normal anatomy and physiology and their variants. The radiology of congenital and acquired diseases of the bladder and urethra will be demonstrated by cystourethrograms. Periurethral calcification and prostatic disease will also be discussed.

Course No. 12: Monday, 8:30-10:00 A.M.

Radiotherapy of Carcinoma of the Larynx

JUAN A. DEL REGATO, M.D., Colorado Springs, Colo.

A plan of radiotherapy will be given for cancer of the larynx. It will be shown how the technic must vary with involvement of the perilyngeal structures.

Course No. 13: Monday, 8:30-10:00 A.M.

Basic Radiation Dosimetry

H. O. WYCKOFF, Ph.D., Washington, D. C.

The text for the course is the 1959 *Recommendations of the International Commission on Radiological Units and Measurements*.¹ The difference between the exposure dose in roentgens, the absorbed dose in rads, and the RBE dose in rems will be pointed out. Data on energy dependence and rate dependence or r-meters will be presented, and suggestions will be made on methods for checking the reproducibility of such instruments. Direct measurement of the absorbed dose by calorimetric

means will be discussed, but the principal method considered will be the absorbed dose from ionization measurements.

Course No. 14: Monday, 10:30-12:00 A.M.

Architectural Planning of a Department of Radiology

G. W. CALLEDINE, JR., Ph.D., Columbus, Ohio

Some radiology departments are planned, others just grow. Many architects consider the Radiology Department the most complex department in the hospital to design successfully. The reasons for this will be considered. The roles of the various people responsible for the planning of a department and their inter-relations will be discussed. Type of planning will be related to patients, to method of practice, to consulting medical staff, and to employees. Specific problems in design will be studied. These will include traffic flow (patient, personnel, films, and records), processing, placement of equipment, shielding requirements, etc. Differences in approach necessitated by new and remodeling planning will be discussed, as will some of the aspects of office *versus* hospital practice. Specific departments will be analyzed to demonstrate strengths and weaknesses of planning. Sufficient time will be allotted to discussion of problems from the floor.

Course No. 15: Monday, 10:30-12:00 A.M.

Advanced Breast Carcinoma

ORLISS WILDERMUTH, M.D., Seattle, Wash.

Advanced carcinoma of the breast has long plagued physicians, and particularly the radiologist. A rational approach to the problem will be discussed.

Course No. 16: Monday, 10:30-12:00 A.M.

Interstitial Radium Therapy

JOHN BOLAND, M.D., New York, N. Y.

SERGEI FEITELBERG, M.D., New York, N. Y.

The present-day indications for the use of interstitial radium and radon therapy will be evaluated in terms of the theoretical distribution of dosage which can be obtained. This distribution will be compared with external radiation methods.

Practical hints on planning of the treatment and the surgical technic of implantation will be given.

Reconstructions of actual implants will be used to illustrate the methods of calculating the dose rate and the required time.

The management of acute and chronic reaction will be discussed.

Five-year results will be presented in terms of various dose levels which lead to our recommendation as to the optimum dose.

(This course continued Tuesday, Course No. 26)

¹ 1959 Report of the International Commission on Radiological Units and Measurements, to be published as revision of National Bureau of Standards *Handbook 62*.

Course No. 17: Monday, 10:30-12:00 A.M.
Pulmonary Manifestations of the Collagen Diseases

WILLIAM R. EYLER, M.D., Detroit, Mich.
 JOSEPH C. SIERACKI, M.D., Danville, Penna.

This course will be based on a series of patients studied radiographically and pathologically. Particular emphasis will be placed on scleroderma, but examples will be shown of all of the collagen diseases, including lupus erythematosus, periarteritis nodosa, Wegener's granulomatosis, dermatomyositis, polymyositis, rheumatoid arthritis, rheumatic fever, and thrombotic thrombocytopenic purpura. Particular emphasis will be placed on the *correlation* of radiographic and pathologic studies.

Some examples of other diseases producing diffuse pulmonary abnormalities will be shown for comparison. Cases of agammaglobulinemia, sarcoid, eosinophilic granuloma, and Hamman-Rich disease will be briefly illustrated from the radiologic aspect only.

Course No. 18: Monday, 10:30-12:00 A.M.
Metabolic and Endocrine Diseases Involving the Skeletal System

HOWARD L. STEINBACH, M.D., San Francisco, Calif.

The major endocrine and metabolic factors affecting growth and maturation, and some recent concepts of the dynamic aspects of bone composition, physiology, and pathology, will be discussed. To be considered are the radiologic aspects of the more common metabolic diseases such as osteoporosis and osteomalacia and Paget's disease, and the unusual manifestations of these conditions.

The second part of the discussion will deal with endocrine abnormalities producing skeletal alterations, recognizable by roentgenographic methods.

(This course continued Tuesday, Course No. 28)

Course No. 19: Monday, 10:30-12:00 A.M.
Angiocardiographic Findings in Congenital Heart Disease

WILLIAM T. MESZAROS, M.D., Chicago, Ill.

I. No shunt

Fibroelastosis. Myocarditis
 Pulmonary artery coarctation
 Idiopathic dilatation of the pulmonary artery
 Pericardial effusion. Coarctation of the aorta
 Dextrocardia, complete and incomplete
 Aortic regurgitation. Marfan's syndrome
 Pulmonary valvular stenosis
 Primary pulmonary hypertension

II. Right-to-left shunt

Tetralogy of Fallot. Pentalogy. Truncus arteriosus

Taussig-Bing complex. Double outlet right ventricle

Complete transposition of great vessels:

With atrial septal defect

With ventricular septal defect

With single ventricle

With patent ductus

With pulmonic stenosis

Tricuspid atresia. Tricuspid atresia with transposition

Eisenmenger complex. Reversed ductus arteriosus

Total anomalous pulmonary venous drainage

III. Left-to-right shunt

Atrial septal defect. Ventricular septal defect

Common atrioventricular valve. Patent ductus arteriosus

Coronary arteriovenous fistula

Aortic septal defect. Partial anomalous pulmonary venous drainage

Course No. 20: Monday, 10:30-12:00 A.M.

The Upper Gastrointestinal Tract

WENDELL P. STAMFLEI, M.D., Denver, Colo.

The technic of the upper gastrointestinal tract examination will be reviewed, with special emphasis on the method of mucosal exploration. Lesions that involve the esophagus, and particularly those that affect its motility and the integrity of its opening and closing mechanism, will be discussed. An attempt will be made to describe the roentgenologic dissimilarities that exist in benign and malignant disease of the stomach and, finally, the subject of postbulbar ulcer will be presented in detail. These ulcers constitute an important clinical entity with interesting radiographic features. One feature, the "pseudo-mass" deformity, will be stressed because it sometimes leads to the erroneous diagnosis of neoplasm.

(This course continued Tuesday, Course No. 30)

Course No. 21: Monday, 10:30-12:00 A.M.

Radiology of the Larynx and Pharynx

ARNOLD L. BACHMAN, M.D., New York, N. Y.

This course includes radiographic anatomy and physiology of the larynx, radiology of laryngeal paralysis, radiology of normal and abnormal swallowing patterns, tumors of the larynx and pharynx, and demonstration of extension of laryngopharyngeal tumors. In addition, certain benign conditions will be discussed, including foreign bodies of the cervical esophagus, cricopharyngeal spasm, and radiology of the adenoids.

(This course continued Tuesday, Course No. 31)

PLAN OF PRESENTATION

<p>SUNDAY, Dec. 4 2:00-4:00 P.M.</p> <p>1. Therapy Information Session Donn G. Mosser, M.D., Moderator Orliss Wildermuth, M.D. Robert J. Bloor, M.D. Robert Robbins, M.D.</p>	<p>MONDAY, Dec. 5 8:30-10:00 A.M.</p> <p>4. Treatment Planning: X-rays of Conventional Energy A. Raveitos, M.D. J. Hale, Ph.D.</p>	<p>MONDAY, Dec. 5 10:30-12:00 A.M.</p> <p>14. Architectural Planning of a Department of Radiology G. W. Callendine, Jr., Ph.D.</p>	<p>TUESDAY, Dec. 6 8:30-10:00 A.M.</p> <p>24. Carcinoma of the Cervix Juan A. del Regato, M.D.</p>
<p>2. Current Developments in the Legal Control of Radiation Exposure George T. Frampton, Professor of Law, University of Illinois College of Law, Urbana, Ill.</p>	<p>5. Practical Techniques in Pediatric Radiology Lawrence A. Davis, M.D.</p>	<p>15. Advanced Breast Carcinoma Orliss Wildermuth, M.D.</p>	<p>25. Treatment Planning with High-Energy Radiation (Particularly Telecobalt) Lucille A. Du Sault, A.B. Robert J. Bloor, M.D.</p>
<p>4:30-5:30 P.M.</p>	<p>6. Therapeutic Applications of Radioactive Isotopes E. R. King, MC USN</p>	<p>16. Interstitial Radium Therapy (Cont. Tuesday, Course No. 26) John Boland, M.D. Sergei Feitelberg, M.D.</p>	<p>26. Interstitial Radium Therapy (Cont. from Monday, Course No. 16) John Boland, M.D. Sergei Feitelberg, M.D.</p>
<p>7. The Small Intestine (Cont. Wednesday, Course No. 43) Richard H. Marshak, M.D.</p>	<p>17. Pulmonary Manifestations of the Collagen Diseases William R. Eyler, M.D. Joseph C. Sieracki, M.D.</p>	<p>27. The RSNA Radiotherapy Charts John Hale, Ph.D. Milford Schulz, M.D.</p>	<p>28. Metabolic and Endocrine Diseases Involving the Skeletal System (Cont. Tuesday, Course No. 28) Howard L. Steinbach, M.D.</p>
<p>7:30-9:30 P.M.</p>	<p>8. Radiation and Chemical: Time-Dose Responses with Two Modalities Sydney F. Thomas, M.D.</p>	<p>18. Metabolic and Endocrine Diseases Involving the Skeletal System (Cont. Tuesday, Course No. 28) Howard L. Steinbach, M.D.</p>	<p>29. Statistics of Radiological Surveys E. L. Saenger, M.D. T. D. Sterling, Ph.D.</p>
<p>3. Film Interpretation Session Bernard J. O'Loughlin, M.D., Moderator Harry Z. Mellins, M.D. Benjamin Felson, M.D. J. E. Miller, M.D. L. Henry Garland, M.B.</p>	<p>9. Bronchography William Molnar, M.D.</p>	<p>19. Angiocardiographic Findings in Congenital Heart Disease William T. Meszaros, M.D.</p>	<p>30. The Upper Gastrointestinal Tract (Cont. from Monday, Course No. 20) Wendell P. Stampfli, M.D.</p>
<p>7:30-9:30 P.M.</p>	<p>10. Recent Developments in Radiation Biology T. C. Evans, Ph.D.</p>	<p>20. The Upper Gastrointestinal Tract (Cont. Tuesday, Course No. 30) Wendell P. Stampfli, M.D.</p>	<p>31. Radiology of the Larynx and Pharynx (Cont. from Monday, Course No. 21) Arnold L. Bachman, M.D.</p>
<p>11. Male Cystourethrography Nathaniel Finby, M.D.</p>	<p>21. Radiology of the Larynx and Pharynx (Cont. Tuesday, Course No. 31) Arnold L. Bachman, M.D.</p>	<p>32. Neuroradiology (Cont. Wednesday, Course No. 42) Alfred L. Schmitz, M.D.</p>	<p>33. Therapeutic Uses of Radioisotopes (Dosimetry) W. K. Sinclair, Ph.D.</p>
<p>12. Radiotherapy of Carcinoma of the Larynx Juan A. del Regato, M.D.</p>	<p>22. Pancreatic Carcinoma and Its Early Radiographic Recognition on Gastrointestinal Studies Julian O. Salik, M.D.</p>	<p>34. Respiratory Distress in the Newborn Victor G. Mikity, M.D.</p>	
<p>13. Basic Radiation Dosimetry H. O. Wykoff, Ph.D.</p>			

WEDNESDAY, Dec. 7 8:30-10:00 A.M.		THURSDAY, Dec. 8 8:30-10:00 A.M.		FRIDAY, Dec. 9 8:30-10:00 A.M.	
34. Treatment Planning with High-Energy Electrons R. F. Nelson J. L. Gaspar	44. Free Radicals in Medical Research B. Commoner, Ph.D.	54. Prognostic Significance of Some of the Secondary Manifestations of Lung Cancer Gwynith S. Lodwick, M.D.	55. Examination of the Gastrointestinal Tract in Infants and Children Lawrence A. Davis, M.D.	56. Mammalian Radiobiology E. F. Riley, Ph.D. J. W. Osborne, Ph.D.	57. Radiology of Congenital Heart Disease (Cont. from Thursday, Course No. 47) John A. Campbell, M.D. Eugene C. Klatte, M.D. John A. Campbell, M.D. Eugene C. Klatte, M.D.
35. Myelography: Technic and Interpretation (Cont. Thursday, Course No. 45) Sidney P. Traub, M.D.	45. Myelography: Technic and Interpretation (Cont. from Wednesday, Course No. 35) Sidney P. Traub, M.D.	58. Common Causes of Radiation Hazards Carl B. Braestrup, P.E.	59. Cerebral Angiography (Cont. from Thursday, Course No. 49) J. E. Whiteleather, M.D.	60. Diagnostic Applications of Radioactive Isotopes (Cont. from Wednesday, Course No. 40) J. P. Storaasli, M.D. J. H. Christie, M.D. I. S. Krohmer, M.A.	61. Radiation Therapy of Lung Cancer Eugene Bronstein, M.D. Edward Holodny, B.S.
36. Physics of Radiography M. Ter-Pogossian, Ph.D.	46. Dosage in Internal Use of Radium and Radioisotopes as Discrete Sources E. F. Focht, B.A.	62. Roentgen Manifestations of Some Diseases of Bones and Joints (Cont. from Thursday, Course No. 52) Harold G. Jacobson, M.D.	63. Instrumentation of Clinical Radiological Physics C. S. Simons, Ph.D.	64. The Colon: Examination of the Rectum and Sigmoid George Miller, M.D., Moderator Alice Ettinger, M.D. Henry C. Forrester, M.D. Stewart Jones, M.D.	65. Roentgen Manifestations of Some Diseases of Bones and Joints (Cont. from Friday, Course No. 62) Harold G. Jacobson, M.D.
37. Simultaneous Biligraphy: Technic and Interpretation Oscar M. Weaver, Jr., M.D.	47. Radiology of Congenital Heart Disease (Cont. Friday, Course No. 57) John A. Campbell, M.D. Eugene C. Klatte, M.D.	66. Fluoroscopy: Physics, Electronics, and Physiology E. W. Webster, Ph.D.	67. The Small Intestine (Cont. from Monday, Course No. 7) Richard H. Marshak, M.D.	68. Instrumentation of Clinical Radiological Physics C. S. Simons, Ph.D.	69. Roentgen Manifestations of Some Diseases of Bones and Joints (Cont. from Friday, Course No. 62)
38. Bone-Marrow Transplantation in Radiation Protection V. P. Bond, M.D.	48. Cancer Chemotherapy in Radiological Practice Bernard Roswit, M.D.	70. Diagnostic Applications of Radioactive Isotopes (Cont. from Wednesday, Course No. 40) J. P. Storaasli, M.D. J. H. Christie, M.D. I. S. Krohmer, M.A.	71. Neuroradiology (Cont. from Tuesday, Course No. 32) Alfred L. Schmitz, M.D.	72. Roentgen Manifestations of Some Diseases of Bones and Joints (Cont. from Friday, Course No. 62)	73. Instrumentation of Clinical Radiological Physics C. S. Simons, Ph.D.
39. Clinical Experience with Several Thousand Cases Treated by Supervoltage and Megavoltage Therapy Gilbert H. Fletcher, M.D.	49. Cerebral Angiography (Cont. Friday, Course No. 59) J. E. Whiteleather, M.D.	74. The Small Intestine (Cont. from Monday, Course No. 7) Richard H. Marshak, M.D.	75. Fluoroscopy: Physics, Electronics, and Physiology E. W. Webster, Ph.D.	76. Instrumentation of Clinical Radiological Physics C. S. Simons, Ph.D.	77. Roentgen Manifestations of Some Diseases of Bones and Joints (Cont. from Friday, Course No. 62)
40. Diagnostic Applications of Radioactive Isotopes (Cont. Thursday, Course No. 50) J. P. Storaasli, M.D. J. H. Christie, M.D. I. S. Krohmer, M.A.	50. Diagnostic Applications of Radioactive Isotopes (Cont. from Wednesday, Course No. 40) J. P. Storaasli, M.D. J. H. Christie, M.D. I. S. Krohmer, M.A.	78. The Colon: Examination of the Rectum and Sigmoid George Miller, M.D., Moderator Alice Ettinger, M.D. Henry C. Forrester, M.D. Stewart Jones, M.D.	79. The Small Intestine (Cont. from Monday, Course No. 7) Richard H. Marshak, M.D.	80. Instrumentation of Clinical Radiological Physics C. S. Simons, Ph.D.	81. Roentgen Manifestations of Some Diseases of Bones and Joints (Cont. from Friday, Course No. 62)
41. Symposium: Total-Body Irradiation E. R. King, M.D. J. S. Burkle, M.D. R. Cavalieri, M.D. T. C. Hartney, M.D.	82. Roentgen Manifestations of Some Diseases of Bones and Joints (Cont. from Friday, Course No. 62)	83. Instrumentation of Clinical Radiological Physics C. S. Simons, Ph.D.	84. The Small Intestine (Cont. from Monday, Course No. 7) Richard H. Marshak, M.D.	85. Fluoroscopy: Physics, Electronics, and Physiology E. W. Webster, Ph.D.	86. Instrumentation of Clinical Radiological Physics C. S. Simons, Ph.D.

Course No. 22: Monday, 10:30-12:00 A.M. **Course No. 26: Tuesday, 8:30-10:00 A.M.**

Pancreatic Carcinoma and Its Early Radiographic Recognition on Gastrointestinal Studies

JULIAN O. SALIK, M.D., Baltimore, Md.

The radiologic picture produced by large lesions of the pancreas has been adequately described, but the more subtle changes on the mesial border of the duodenum are often overlooked, especially in non-jaundiced patients. A number of representative cases will be shown and the differential diagnosis of these lesions will be discussed.

Course No. 23: Monday, 10:30-12:00 A.M.

Respiratory Distress in the Newborn

VICTOR G. MIKITY, M.D., Los Angeles, Calif.

The common as well as the more unusual causes of respiratory distress in the newborn infant will be reviewed. Emphasis will be placed on the differential diagnosis and on correlation with the clinical and pathological findings. The diseases will include the following:

1. Hyaline membrane disease
2. Aspiration pneumonia
3. Pneumomediastinum and pneumothorax
4. Congenital intrauterine pneumonia
5. Bacterial pneumonias
6. Congenital cystic disease of the lung
7. Congenital bronchial defects
8. Idiopathic pulmonary fibrosis of the premature
9. The problem of the incompletely expanded lung

Course No. 24: Tuesday, 8:30-10:00 A.M.

Carcinoma of the Cervix

JUAN A. del REGATO, M.D., Colorado Springs, Colo.

In the treatment of carcinoma of the cervix, the chances of cure of even advanced cases depend on the thoroughness of irradiation and the adequacy of its planning. The technic of external irradiation will be discussed in particular detail.

Course No. 25: Tuesday, 8:30-10:00 A.M.

Treatment Planning with High-Energy Radiation (Particularly Telecobalt)

LUCILLE A. DU SAULT, A.B., Detroit, Mich.
ROBERT J. BLOOR, M.D., Detroit, Mich.

Dosage calculation for stationary and rotational technics will be explained, including special problems such as oblique fields, compensating filters, and changes in treatment distance. Ways of altering dose distribution will be described for both technics. Clinical factors governing the type of treatment plan will be discussed in reference to the choice of specific field arrangements.

Interstitial Radium Therapy

JOHN BOLAND, M.D., New York, N.Y.
SERGEI FEITELBERG, M.D., New York, N.Y.
(Continued from Monday, Course No. 16)

Course No. 27: Tuesday, 8:30-10:00 A.M.

The RSNA Radiotherapy Charts

JOHN HALE, Ph.D., Philadelphia, Penna.
MILFORD SCHULZ, M.D., Boston, Mass.
(For the Physics Committee of the RSNA)

The Radiological Society of North America has now made available to the medical community the new Forms and Records for Radiation Therapy which it commissioned its Physics Committee to prepare some years ago. The purpose of this course is to review the use of these new charts for those who may be unfamiliar with them, and to show by example the advantages of their use. Pertinent problems in dosimetry will also be discussed as they relate to the use of the charts.

Course No. 28: Tuesday, 8:30-10:00 A.M.

Metabolic and Endocrine Diseases Involving the Skeletal System

HOWARD L. STEINBACH, M.D., San Francisco, Calif.
(Continued from Monday, Course No. 18)

Course No. 29: Tuesday, 8:30-10:00 A.M.

Statistics of Radiological Surveys

E. L. SAENGER, M.D., Cincinnati, Ohio
T. D. STERLING, Ph.D., Cincinnati, Ohio

Today much of the work of the radiologist is affected by various studies based on statistical methods. Several epidemiological studies have been of particular importance. These include the effects of radiation exposure on life span of radiologists, induction of leukemia after therapy for ankylosing spondylitis, induction of leukemia in children following a prenatal diagnostic roentgenogram, and neoplasia following irradiation for benign conditions in childhood. These studies have sometimes resulted in rather violent discussions in the literature.

The present discussion will point out the importance of experimental design and statistical analysis in the conclusions drawn from such studies and will emphasize the importance of these methods both in respect to clinical and experimental work in radiology.

Course No. 30: Tuesday, 8:30-10:00 A.M.

The Upper Gastrointestinal Tract

WENDELL P. STAMPFLI, M.D., Denver, Colo.
(Continued from Monday, Course No. 20)

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Course No. 31: Tuesday, 8:30-10:00 A.M.**Radiology of the Larynx and Pharynx**

ARNOLD L. BACHMAN, M.D., New York, N.Y.

(Continued from Monday, Course No. 21)

Course No. 32: Tuesday, 8:30-10:00 A.M.**Neuroradiology**

ALFRED L. SCHMITZ, M.D., Los Angeles, Calif.

Bone changes in meningiomas, acoustic nerve tumors, and sellar tumors will be discussed. The technic and the normal roentgen anatomy in fractional encephalography will be illustrated. Normal encephalograms will be compared with those showing changes in the ventricular system and cisterns secondary to tumor pathology. Cerebral arteriograms will be presented to augment the encephalographic studies.

(This course continued Wednesday, Course No. 42)

Course No. 33: Tuesday, 8:30-10:00 A.M.**Therapeutic Uses of Radioisotopes (Dosimetry)**

W. K. SINCLAIR, Ph.D., Houston, Texas

The therapeutic use of radioisotopes depends on the deposition of as much radiant energy as possible at the disease site, with the minimum dissipation of energy in healthy tissues elsewhere.

Concentration of the radioactive material at the site of disease must therefore be achieved in one of the following ways.

- I. By metabolic accumulation of the isotope
- II. By the physical nature of the material (colloid)
- III. By deliberate localization of specific sources by intracavitary, interstitial, or superficial means

The basic principles of dosimetry for β and γ radiation will be discussed with references to particular therapeutic procedures from each of the groups listed above.

Course No. 34: Wednesday, 8:30-10:00 A.M.**Treatment Planning with High-Energy Electrons**R. F. NELSON, New York, N.Y.
J. L. GASPAR, Puebla, Mexico

This course is concerned with the use of high-energy electrons (5-25 Mev) in the treatment of cancer. The important physical characteristics of high-energy electrons with regard to clinical application will be discussed. The treatment planning procedures will be described in detail, including measurements of patients, selection of appropriate energy, and determination of optimum weighting of

fields, field sizes, and beam directions. The use of plastic wedges will also be discussed. The construction of alignment masks and the general problem of alignment will be considered, together with the mounting of wedges on the masks. A number of cases illustrating specific features of electron-beam therapy will be presented, primarily for lesions in the head and neck areas and in subcutaneous tissues.

Course No. 35: Wednesday, 8:30-10:00 A.M.**Myelography: Technic and Interpretation**

SIDNEY P. TRAUB, M.D., Saskatoon, Canada

This course is designed to cover the practical aspects of myelography of importance to the roentgenologist. The following outline will be observed:

Part I

1. Brief historical review
2. Indications for myelography; contraindications
3. Pertinent anatomy and anatomic variations of subarachnoid space
4. Basic principles in myelographic technic
5. Complications of myelography and their significance
6. Intervertebral disk protrusions:
 - a. Value of chest and spine roentgenograms
 - b. Cervical disk protrusions
 - c. Thoracic disk protrusions
 - d. Lumbar disk protrusions
7. The postoperative myelogram
8. Limitations of discography; gas myelography; water-soluble myelography

Part II

1. Congenital lesions:
 - a. Diastematomyelia
 - b. Lumbar, sacral, and intrathoracic meningoceles
 - c. Perineurial and extradural cysts
2. Vascular malformations
3. Traumatic lesions
4. Inflammatory lesions
5. Intraspinal tumors: Extradural, intradural (extramedullary), and intramedullary tumors will be discussed under:
 - a. Classification and incidence
 - b. Plain film changes
 - c. Myelography appearance
6. Summary and general discussion including:
 - a. Common errors in myelographic interpretation
 - b. Value and limitations of the myelographic examination in patients with intraspinal disease

(This course continued Thursday, Course No. 45)

Course No. 36: Wednesday, 8:30-10:00 A.M.

Physics of Radiography

M. TER-POGOSSIAN, Ph.D., St. Louis, Mo.

In radiography the conversion of the energy carried by the x-ray photons into usable visual information is governed by a series of physical factors. These factors are: maximum energy and energy distribution of the photons generated, focal spot size of the x-ray tube, filtration of the beam, focal skin and focal film distances, field size, type of device used for the removal of scattered radiation, characteristics of intensifying screens and film used, and development of the film.

The nature of the radiographic examination planned determines, often uniquely, an optimal setting of the above physical factors which provide maximum information pertaining to the desired examination. Particular emphasis is put on contrast radiography, and high energy (above 125 kilovolts peak) radiography.

Course No. 37: Wednesday, 8:30-10:00 A.M.

Simultaneous Biliigraphy: Technic and Interpretation

OSCAR M. WEAVER, Jr., M.D., Welch, W. Va.

Analogous to intravenous urography, simultaneous biliigraphy is a specific procedure designed to evaluate the status of bile flow throughout the intact extrahepatic biliary tract. Functional information concerning the gallbladder and sphincter of Oddi responses to ingested fat, intravenous cholecystokinin, parasympathomimetics, and methantheline derivatives is obtained, in addition to pathomorphological information involving component structures, singly or in combination. The procedure succinctly defines the limitations of oral cholecystography. A working classification of disorders based upon characteristics of abnormal bile flow will be distributed.

Course No. 38: Wednesday, 8:30-10:00 A.M.

Bone-Marrow Transplantation in Radiation Protection

V. P. BOND, M.D., Upton, N. Y.

The background for total-body irradiation and bone-marrow transplants in the therapy of a variety of clinical conditions lies in animal radiation protection studies. These indicate that shielding of the spleen or injection of spleen or bone-marrow preparations affords significant protection of rodents through accelerated bone-marrow regeneration. Earlier work indicated the possibility of a humoral agent; actual cell transplantation was later dem-

onstrated. The resultant stimulation of interest in human marrow transplants was heightened by the demonstration that mouse leukemia might be "cured" by heavy irradiation of animals followed by transplantation of normal marrow to allow survival. Later rejection of marrow homografts occurred, probably on an antibody basis, and the "secondary" or "wasting disease" is seen with transplants of homologous or heterologous marrow. Marrow transplants have now been attempted in a number of patients for leukemia, for marrow aplasia, after irradiation and kidney transplantation, and for victims of reactor accidents. These experiences will be discussed in terms of rationale, clinical indications, technics, possible preservation of marrow, evidence for successful transplant, and possible transplant rejection or other delayed effects. The doses of radiation used will be discussed in terms of the levels at which survival is possible with "supportive" measures only (antibiotics, transfusions, platelets), and the levels at which marrow transplant may be successful and may allow survival.

Course No. 39: Wednesday, 8:30-10:00 A.M.

Clinical Experience with Several Thousand Cases Treated by Supervoltage and Megavoltage Therapy

GILBERT H. FLETCHER, M.D., Houston, Texas

Carcinomas of (1) the uterine cervix, (2) head and neck, (3) urinary bladder, and (4) breast have been the main groups of cancers treated by supervoltage therapy. Another group is composed of those tumors (testis, ovary, lymphomas), necessitating large volume torso therapy. Details of technics and trends in results will be given for each group.

Course No. 40: Wednesday, 8:30-10:00 A.M.

Diagnostic Applications of Radioactive Isotopes

J. P. STORAASLI, M.D., Cleveland, Ohio

J. H. CHRISTIE, M.D., Cleveland, Ohio

J. S. KROHMER, M.A., Dallas, Texas

The most common diagnostic uses of radioactive isotopes will be discussed. The physical requirements as well as the physiopathological criteria for the various clinical applications will be included.

The isotopes to be covered are I^{131} (iodide, serum albumin, rose bengal) Cr^{51} , P^{32} , Au^{198} , and Co^{60} .

The diagnostic applications to be discussed are:

1. Thyroid function studies including uptakes, clearance rates, and protein-bound iodine and thyroid-stimulating hormone tests
2. P^{32} in the diagnosis of intraocular tumors
3. Dilution studies, to include plasma volumes, red cell mass determinations, and measurements of flow rates

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REFRESHER COURSES
THE RADIOLOGICAL SOCIETY
OF NORTH AMERICA

December 4 through December 9

NETHERLAND-HILTON HOTEL

CINCINNATI, OHIO

SEE INSTRUCTIONS ON REVERSE SIDE

(Detach here)

FILL OUT THE FOLLOWING

(You must identify yourself at the Registration Desk)

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Last Name

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CHECK THE FOLLOWING

Member R.S.N.A.

Guest

Resident or fellow in Radiology at present Where.....

Medical Student* Where.....

Reserve Officer on Active Duty at present Trainee in Physics

* You must present a letter of identification from the Dean of your medical school.

Fill out, also, the enrollment diagram on the reverse side of this page

INSTRUCTIONS FOR ENROLLMENT

Read the accompanying description of the courses and plan of presentation. Register early, the number admitted to each course will be limited by the seating capacity of the room. Reservations will be made in the order of the receipt of request. Admission to the Refresher Courses will be by badge and tickets except for Courses Nos. 1, 2, and 3, for which only a badge will be required. No tickets will be issued for these sessions.

Courses are limited to the medical profession, including graduate students and residents, radiology; radiation physicists, radiobiologists, chemists, and others closely allied with the science of radiology; and medical students certified by the deans of their respective colleges.

Residents, interns, and *medical students* will be limited to courses being presented in the Pavilion Caprice Room and Continental Room.

All tickets will be held for you at the R.S.N.A. Registration Desk in the Netherland-Hilton Hotel.

The registration fee, where applicable, will cover the cost of the Refresher Courses. Member guest speakers, guest instructors, scientific exhibitors, residents or fellows in radiology, medical students, members of the Armed Forces, and trainees in physics do not pay a registration fee. Non-members not in these groups will pay, *at the time of registration*, a fee of \$25.00, which will include the Refresher Courses.

If you cannot attend the course reserved for you, kindly notify the Refresher Course Chairman. The seating capacity is very limited in some of the courses and your notice will allow another to attend.

PLEASE INDICATE YOUR FIRST, SECOND, AND THIRD CHOICES

Tickets Will Be Picked Up at Time of Registration

	First Choice		Second Choice		Third Choice	
	Course No.	Instructor	Course No.	Instructor	Course No.	Instructor
Monday, Dec. 5 8:30 A.M.						
Monday, Dec. 5 10:30 A.M.						
Tuesday, Dec. 6						
Wednesday, Dec. 7						
Thursday, Dec. 8						
Friday, Dec. 9						

Mail this order sheet to John W. Walker, M.D., Chairman, Refresher Course Committee.

Prior to Nov. 26, 830 Argyle Bldg., Kansas City 6, Mo.

After Nov. 26, c/o Radiological Society of North America, Netherland-Hilton Hotel, Cincinnati, Ohio

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4. Body scanning, including thyroid, liver, and blood pools
5. Metabolic studies including pancreatic insufficiency studies and assay of "intrinsic factor"
6. The use of Fe^{69} and Cr^{51} in hematologic disorders

(This course continued Thursday, Course No. 50)

Course No. 41: Wednesday, 8:30-10:00 A.M.

Symposium: Total-Body Irradiation

E. R. KING, M.D., Bethesda, Md.
J. S. BURKLE, M.D., St. Albans, N. Y.
R. CAVALIERI, M.D., Newington, Conn.
T. C. HARTNEY, M.D., Bethesda, Md.

This symposium presents the results and clinical responses of a series of cancer patients treated by a Co^{60} irradiator, the geometry of which, for a human, approaches 4π . Doses varied from 100 to 900 r (air) delivered at dose rates of 7.5 to 30 r/min. Problems involving the clinical management of these patients, the hematologic and biochemical changes that were noted, and the pathological findings will be discussed in this course.

Course No. 42: Wednesday, 8:30-10:00 A.M.

Neuroradiology

ALFRED L. SCHMITZ, M.D., Los Angeles, Calif.
(Continued from Tuesday, Course No. 32)

Course No. 43: Wednesday, 8:30-10:00 A.M.

The Small Intestine

RICHARD H. MARSHAK, M.D., New York, N. Y.
(Continued from Monday, Course No. 7)

Course No. 44: Thursday, 8:30-10:00 A.M.

Free Radicals in Medical Research

B. COMMONER, Ph.D., St. Louis, Mo.

On theoretical grounds, free radicals are expected to occur as decisive intermediates in a number of biochemical processes, especially enzymatic oxidation-reduction and the primary effects of ionizing, ultraviolet, and visible radiation. Early efforts to test these theories were of uncertain outcome because the expected free radical concentrations are extremely low, and sometimes short-lived. The discovery of the phenomenon of electron spin resonance in 1946 has led to new types of investigations which in recent years have produced experimental evidence regarding the occurrence of free radicals in biological and biochemical systems.

Electron spin resonance (ESR) is a phenomenon

which arises from the magnetic moment associated with the spin of the electron. In ordinary molecules all electrons spin in pairs, the spins being opposed; the magnetic properties cancel out and no ESR phenomena are observed. In free radicals, which contain an unpaired electron, the latter will give rise to a resonance absorption of incident energy at a frequency which is determined by the strength of an external magnetic field. Hence, when a sample is exposed to a varying magnetic field, energy will be absorbed from incident microwave radiation. In a typical ESR spectrometer, the incident radiation is at 9000 mc/sec, and ESR absorption occurs at a magnetic field of about 3000 gauss.

ESR signals due to free radicals in biological materials were first discovered at the Washington University Laboratories in 1952. The spectrometer used in early work required that samples be dry, thus precluding kinetic studies of biochemical processes. More recently, a highly sensitive spectrometer capable of detecting about 10^{-11} of a mole of free radical in an aqueous sample of tissue or enzyme system has been developed. With this spectrometer, it has been shown that free radicals occur in a number of active enzymatic redox systems. In several cases quantitative kinetic studies of the free radical concentrations in such systems have led to new evidence regarding the reaction mechanisms involved. Detailed ESR studies of the mechanism of photosynthesis have also been carried out.

ESR studies of a wide range of surviving tissue samples from laboratory animals and man show that these tissues contain free radicals which apparently arise in enzymatic redox processes. Free radical concentrations bear a relation to the metabolic rate characteristic of the tissue. A survey of the ESR signals found in surgical samples from various pathological tissues is in progress. Thus far, evidence has been obtained which shows that in certain liver disorders, marked and characteristic changes in ESR signals occur, and that tumor tissues appear to contain lower free radical concentrations than the corresponding normal tissues. In certain pathological conditions there is a possibility of useful application of ESR to biopsy samples as a diagnostic procedure.

Since ionizing radiation probably induces free radical formation, there is considerable interest in the effects of radiation on the free radical content of tissues. Although such studies present numerous difficulties, several opportunities for new experimental approaches to this problem exist.

Course No. 45: Thursday, 8:30-10:00 A.M.

Myelography: Technic and Interpretation

SIDNEY P. TRAUB, M.D., Saskatoon, Canada

(Continued from Wednesday, Course No. 35)

Course No. 46: Thursday, 8:30-10:00 A.M.**Dosage in Internal Use of Radium and Radioisotopes as Discrete Sources**

E. F. FOCHT, B.A., New York, N. Y.

The principle and techniques of dosage calculations in the use of discrete sources for intracavitory or interstitial therapy are similar for all gamma-emitting isotopes. This course will concentrate mainly on radium, but the fundamentals of amount, exposure, filter, distribution, and resultant dose will be discussed in general. Different systems of radium dosage evaluation and their recent modifications will be analyzed and adapted to the use of such isotopes as cobalt, gold, iridium, etc., including consideration of the time factor. Some "gadgets" to aid in calculation will be demonstrated.

Three-dimensional models of some actual implants will be shown with their radiographs.

An outline of the subject will be given, with references, which should survey the information to date.

Course No. 47: Thursday, 8:30-10:00 A.M.**Radiology of Congenital Heart Disease**JOHN A. CAMPBELL, M.D., Indianapolis, Ind.
EUGENE C. KLATTE, M.D., Indianapolis, Ind.

The advent of successful open heart surgery has changed the importance of roentgen diagnosis of congenital heart disease from a matter of academic interest to one of practical necessity. The roentgenologist serves several key functions in the diagnosis of the lesions. It is frequently his original fluoroscopic and plain film interpretations which lead to the recognition of these malformations, and distinguish those requiring more specialized diagnostic studies. As a member of the hospital cardiology team, the radiologist provides an indispensable service by performing selective cardioangiographic procedures which yield precise information about the altered morphology and hemodynamics.

The course will present the plain film and cardioangiographic diagnosis of the common types of congenital heart disease. Cineradiographic studies will be used to illustrate the pathological anatomy and physiology of the different conditions. The differential diagnosis of those lesions producing similar clinical features will be emphasized.

Period I

1. Basic considerations in roentgen diagnosis
2. Patent ductus arteriosus
3. Ventricular septal defect
4. Atrial septal defect
5. Anomalous pulmonary venous return

Period II

1. Coarctation of aorta
2. Fibroelastosis and myocardial disease
3. Pulmonary stenosis

4. Tetralogy of Fallot
5. Tricuspid atresia
6. Truncus arteriosus
7. Transposition of great vessels
8. Miscellaneous

(This course continued Friday, Course No. 57)

Course No. 48: Thursday, 8:30-10:00 A.M.**Cancer Chemotherapy in Radiological Practice**

BERNARD ROSWIT, M.D., Bronx, N. Y.

Patients and colleagues generally look to the therapeutic radiologist as the most knowledgeable specialist in the treatment of inoperable cancer. Cytotoxins, antimetabolites, antibiotics, steroids, and radiation synergists have recently gained great importance as adjuncts to radiation treatment. It is essential that radiologists keep abreast of these new developments to improve their management of patients with advanced disease. This course has therefore been planned by a radiologist for radiologists to discuss available drugs, dosage, indications, clinical effectiveness, complications, and integration with the radiation treatment as well as the trend of future developments in this field.

Course No. 49: Thursday, 8:30-10:00 A.M.**Cerebral Angiography**

J. E. WHITELEATHER, M.D., Memphis, Tenn.

This will be an informal discussion of the apparatus, methods, and technic of cerebral angiographic examinations.

Normal anatomy, common variations, and pathologic deformities will be presented, including mention of the current concepts of arteriosclerotic disease.

(This course continued Friday, Course No. 59)

Course No. 50: Thursday, 8:30-10:00 A.M.**Diagnostic Applications of Radioactive Isotopes**J. P. STORAASLI, M.D., Cleveland, Ohio
J. H. CHRISTIE, M.D., Cleveland, Ohio
J. S. KROHMER, M.A., Dallas, Texas

(Continued from Wednesday, Course No. 40)

Course No. 51: Thursday, 8:30-10:00 A.M.**The Colon: Examination of the Rectum and Sigmoid**

GEORGE A. MILLER, M.D., Urbana, Ill. Moderator

ALICE ETTINGER, M.D., Brookline, Mass.
HENRY C. FORRESTER, M.D., Burlington, Vt.
STEWART JONES, M.D., Cincinnati, Ohio

This course will cover various standard roentgen methods of examination of the rectum and sigmoid and their relationship to proctologic examination.

Course No. 52: Thursday, 8:30-10:00 A.M.
Roentgen Manifestations of Some Diseases of Bones and Joints

HAROLD G. JACOBSON, M.D., New York, N.Y.

The Arthritides and Allied Disorders: Tuberculosis, rheumatoid arthritis and spondylitis, suppurative arthritis, osteoarthritis, spondylosis deformans, "swayback" syndrome, gout, neuropathic joints, sarcoid, and pigmented villonodular synovitis.

Miscellaneous Skeletal Abnormalities: Paget's disease, fibrous dysplasia, leontiasis ossium, caisson workers' aseptic necrosis, Gaucher's disease, skeletal findings in various blood dyscrasias (agnogenic myeloid metaplasia, sickle-cell anemia, Hodgkin's leukemia, etc.), osteoid osteoma, the important so-called aseptic necroses in childhood (Köhler's, Kienböck's, Freiberg's osteochondritis dissecans, osteochondrosis of the spine, Legg-Perthes', etc.), idiopathic coxa vara of childhood, epiphysiolysis of the femoral capital epiphysis, the reticuloses (eosinophilic granuloma, Hand-Christian-Schüller disease, and Letterer-Siwe disease), hyperparathyroidism, Cushing's syndrome, and hypertrophic pulmonary osteoarthropathy.

A concise but rather complete description of the pathological changes in each of these entities will be presented and the relationship of the pathological findings to the roentgen manifestations will be discussed. The concept of explaining the roentgen findings in terms of the pathologic changes will receive special emphasis.

(This course continued Friday, Course No. 62)

Course No. 53: Thursday, 8:30-10:00 A.M.

Fluoroscopy: Physics, Electronics, and Physiology

E. W. WEBSTER, Ph.D., Cambridge, Mass.

The physical and physiological principles involved in fluoroscopy are reviewed with emphasis on quantitative aspects of radiation absorption and scattering, light production, light utilization, and detail perception. The advantages, methods, and basic physical limitations of image intensification are discussed with special reference to quantum noise and the use of electronic contrast enhancement and storage.

Course No. 54: Friday, 8:30-10:00 A.M.

Prognostic Significance of Some of the Secondary Manifestations of Lung Cancer

GWILYM S. LODWICK, M.D., Columbia, Mo.

This course will present experiences in the study of clinical data, roentgenograms, and survival statistics from 542 cases of lung cancer. These data have been compiled and studied by technics similar to those used with a collection of bone sarcomas, and comparisons and parallel conclusions

will be drawn from both series. Roentgen prognostic signs of poor and long survival will be illustrated.

Course No. 55: Friday, 8:30-10:00 A.M.

Examination of the Gastrointestinal Tract in Infants and Children

LAWRENCE A. DAVIS, M.D., Louisville, Ky.

Examination of the gastrointestinal tract in infants and younger children is difficult only in the technical problems involved. Actually, the range of abnormality is limited, and does not compare with the pathological complexities found in the adult. This course will stress these technical problems and how they can be easily solved by the radiologist and one technician. The various congenital and acquired diseases found in pediatric practice will be analyzed, and the use of water-soluble opaque media will be discussed.

Course No. 56: Friday, 8:30-10:00 A.M.

Mammalian Radiobiology

E. F. RILEY, Ph.D., Iowa City, Iowa
J. W. OSBORNE, Ph.D., Iowa City, Iowa

I. Principles illustrated by radiation cataract studies (E. F. Riley).

- Primary site of radiation injury; lens vs. ciliary body
- Variable sensitivity of cells in lens
- Early changes; one to four weeks post-irradiation
- Later changes; more than four weeks post-irradiation
- Limiting of cataract by shielding part of lens
- Relative effectiveness of x-rays and neutrons
- Threshold exposures

II. Principles illustrated by studies of the irradiated intestine (J. W. Osborne)

- Irradiation of the total body
- Irradiation of only the small intestine
- Surgical procedures prior to and after irradiation of the small intestine
- Incidence of carcinoma of the small bowel following x-irradiation

Course No. 57: Friday, 8:30-10:00 A.M.

Radiology of Congenital Heart Disease

JOHN A. CAMPBELL, M.D., Indianapolis, Ind.

EUGENE C. KLATTE, M.D., Indianapolis, Ind.

(Continued from Thursday, Course No. 47)

Course No. 58: Friday, 8:30-10:00 A.M.

Common Causes of Radiation Hazards

CARL B. BRAESTRUP, P.E., New York, N.Y.

The hazards associated with the medical use of

roentgen rays and with teletherapy may be minimized by the use of properly constructed equipment, ample room shielding, and, most important, appropriate operating procedures. These factors will be discussed from the point of view of the safety of the patient, staff, and public. The subject will be further subdivided into fluoroscopy, radiography, roentgen therapy, and teletherapy with emphasis given to the necessary safeguards of each application.

Course No. 59: Friday, 8:30-10:00 A.M.

Cerebral Angiography

J. E. WHITELEATHER, M.D., Memphis, Tenn.

(Continued from Thursday, Course No. 49)

Course No. 60: Friday, 8:30-10:00 A.M.

Radioactive Isotope Statistics

T. D. STERLING, Ph.D., Cincinnati, Ohio

E. L. SAENGER, M.D., Cincinnati, Ohio

In using radioisotopes, the validity of the results obtained depend in great part on the understanding of statistics of radioactive decay. Topics to be discussed include the following:

1. The error in a counting determination
2. Which distribution should be used and why?
3. How many counts are needed?
4. What is the best ratio of background to sample counting times?
5. How significant is the difference between two counts?
6. What should be the ground rules of counting?

Course No. 61: Friday, 8:30-10:00 A.M.

Radiation Therapy of Lung Cancer

EUGENE BRONSTEIN, M.D., New York, N. Y.

EDWARD HOLODNY, B.S., New York, N. Y.

The role of radiotherapy in the treatment of lung cancer has assumed great importance in recent years with the rapid increase in the incidence

of the disease and newer technics of treatment. The course will review curative and palliative approaches to therapy using supervoltage and orthovoltage. In addition, the indications and results of interstitial radiation with radioactive sources will be shown. The use of chemotherapy as a specific adjunct to radiation therapy in lung cancer will be discussed. Finally, a uniform and accurate method of dosage calculation using exit dosimetry will be illustrated.

Course No. 62: Friday, 8:30-10:00 A.M.

Roentgen Manifestations of Some Diseases of Bones and Joints

HAROLD G. JACOBSON, M.D., New York, N. Y.

(Continued from Thursday, Course No. 52)

Course No. 63: Friday, 8:30-10:00 A.M.

Instrumentation for Clinical Radiological Physics

C. S. SIMONS, Ph.D., Ann Arbor, Mich.

From the standpoint of using readily available commercial instruments, this course will review for the radiologist some practical methods of determining the following information:

- a. Exposure dose and exposure dose rate
- b. Absorbed dose and absorbed dose rate
- c. Half-value layer
- d. Central axis depth dose value

In addition, the use of portable monitoring equipment will be considered in performing radiation surveys of radiation therapy installations comprising:

- a. Teletherapy units
- b. Deep therapy units
- c. Superficial therapy units

A listing of the minimum essential equipment for use in a hospital physicist's office will be presented and discussed.

Radioisotope instrumentation will not be treated.

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ANNOUNCEMENTS AND BOOK REVIEWS

EASTERN RADILOGICAL SOCIETY

New officers of the Eastern Radiological Society are: President, Ted F. Leigh, M.D., Atlanta, Ga.; Vice-President, James F. Martin, M.D., Winston-Salem, N. C.; Secretary-Treasurer, John D. Osmond, Jr., M.D., 101 E. 185th St., Cleveland, Ohio.

RADILOGICAL SOCIETY OF HAWAII

At a recent meeting of the Radiological Society of Hawaii, the following officers, all of Honolulu, were elected: President, Robert G. Rigler, M.D.; Vice-President, H. C. Chang, M.D.; Secretary-Treasurer, Philip S. Arthur, M.D., 274 Young Hotel Bldg., Honolulu.

The Society meets monthly on the third Monday at 7.30 P.M., at a place designated by the Secretary.

INDIANA ROENTGEN SOCIETY

The Indiana Roentgen Society, Inc., at its Spring meeting elected officers, all of Indianapolis, as follows: Chester A. Stayton, Jr., M.D., President; John W. Beeler, M.D., President-Elect; David E. Wheeler, M.D., 1500 N. Ritter Ave., Indianapolis, Secretary-Treasurer.

Meetings are held twice yearly: the first Sunday in May and during the Fall meeting of the Indiana State Medical Association.

LOS ANGELES RADILOGICAL SOCIETY

Robert Rickenberg, M.D., took office as President of the Los Angeles Radiological Society on Sept. 1, 1960. Other officers of the Society are: Vice-President, Robert Engle, M.D.; Treasurer, Denis Adler, M.D.; Secretary, Walter L. Stilson, M.D., 1720 Brooklyn Ave., Los Angeles 33; Councilor to the American College of Radiology, M. Mortimer Haskell, M.D.; Alternate Councilor, John H. Woodruff, Jr., M.D. Member of Executive Committee for three years, Putnam Kennedy, M.D.

The Society meets the second Wednesday of September, November, January, April, June, Los Angeles County Medical Association Building.

NEW ENGLAND ROENTGEN RAY SOCIETY

Officers of the New England Roentgen Ray Society for 1960-61 are: Arnold H. Janzen, M.D., Hartford, Conn., President; John E. Gary, M.D., Brookline, Mass., President-Elect; Gerald Lavner, M.D., Haverhill, Mass., Vice-President; H. Peter Mueller, M.D., Belmont, Mass., Treasurer; Robert E. Wise, M.D., 605 Commonwealth Ave., Boston 15, Mass., Secretary.

The Society meets monthly on the third Friday, October through May, at Longwood Towers, Brookline, Mass.

OREGON RADILOGICAL SOCIETY

The Oregon Radiological Society at a recent meeting chose as officers for the coming year: President, C. V. Allen, M.D., Portland; President-Elect, L. Allen Gay, M.D., The Dalles; Secretary-Treasurer, George R. Satterwhite, M.D., 1123 S. W. Yamhill St., Portland.

W. EDWARD CHAMBERLAIN LECTURE

On Wednesday, Sept. 28, in the Temple University Medical School Auditorium, Philadelphia, S. R. M. Reynolds, Professor of Anatomy, University of Illinois College of Medicine, delivered the fourth lecture correlating physiology and radiology honoring Dr. W. Edward Chamberlain. Dr. Reynolds' topic was *Nature of the Fetal Circulation and the Changes at Birth as Revealed Primarily by Cineradiography*. An informal dinner at the Alden Park Manor followed.

LAURISTON S. TAYLOR HONORED

Lauriston S. Taylor, of the National Bureau of Standards, was recently awarded an Honorary Doctorate of Science by the University of Pennsylvania. The citation accompanying the award reads as follows:

"Your education in physics has led you simultaneously into several broad, yet specialized fields, to all of which you have made signal contributions.

"In the investigation of the measurement of radiation dose, you have been a pioneer, and your leadership has brought about standardization of measurement processes at the international level. As a senior officer in the National Bureau of Standards, you have been concerned with the problems of radiation safety, and you have been instrumental in presenting accurate information to the citizenry and in assisting the various states to formulate protective legislation.

"During the last war your original ideas in behalf of the United States Air Force in England proved to be a vital factor in the early development of operations research."

DEPARTMENT OF RADIOLOGY TULANE UNIVERSITY

Dr. Charles M. Nice, Jr., Professor of Radiology at Tulane University School of Medicine, has recently been appointed Chairman of the newly created Department of Radiology in that institu-

tion. The new Department succeeds the Division of Radiology within the Department of Medicine. The Division has been headed by Dr. Nice for the past two years. A new full-time Assistant Professor, Dr. Joseph L. Izenstark, has been added to the radiological faculty.

**CONTINUATION COURSE IN RADIATION THERAPY FOR RADIOLOGISTS
UNIVERSITY OF MINNESOTA**

The University of Minnesota announces a continuation course in Radiation Therapy for radiologists to be held Oct. 31-Nov. 4, 1960, in the Mayo Memorial Auditorium at the University of Minnesota Medical Center. Guest participants will include Dr. Jean Bouchard, Associate Professor of Radiology, McGill University Faculty of Medicine, and Chief, Division of Radiation Therapy, Royal Victoria Hospital, Montreal, Quebec; Dr. George W. Casarett, Associate Professor of Radiation Biology and Research Radiation Pathologist, Division of Radiation Therapy, University of Rochester School of Medicine and Dentistry, Rochester, N. Y.; Dr. Charles Heidelberger, Professor of Physiological Chemistry, University of Wisconsin Medical School, Madison, Wisc.; Dr. Morton M. Kligerman, Professor and Chairman of Radiology, Yale University School of Medicine, New Haven, Conn.; Dr. Manuel Lederman, Radiotherapist, Royal Marsden Hospital, London, England; Dr. Charles L. Martin, The Martin X-Ray and Radium Clinic, Dallas, Texas; Dr. Philip Rubin, Associate Professor of Radiology and Chief, Division of Radiation Therapy, University of Rochester School of Medicine and Dentistry, Rochester, N. Y.

The course will be presented under the direction of Drs. Harold O. Peterson, Professor and Head, Department of Radiology, and Donn G. Mosser, Professor of Radiology and Director of Radiation Therapy, University of Minnesota Medical School.

Further information may be obtained from W. Albert Sullivan, Jr., M.D., Department of Continuation Medical Education, University of Minnesota Medical School, Minneapolis 14, Minn.

PICKER FOUNDATION FELLOWSHIPS

On behalf of the James Picker Foundation, the National Academy of Sciences-National Research Council announces the award of 18 research grants, 4 fellowships, and 3 grants for scholars in radiological research for the coming academic year. These awards, totaling approximately \$121,000, were recently approved by the Foundation on recommendation of the Committee on Radiology of the Academy-Research Council.

The Picker Foundation, with the advice and cooperation of the Council, initiated its program of research grants and fellowships in 1950, and expanded it to include scholar grants in 1953. The

objective has been to foster research in and broaden the scope of radiology.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

FRACTURES, DISLOCATIONS AND SRAINS. By Philip WILES, M.S. (Lond.), F.R.C.S. (Eng.), F.A.C.S., Honorary Consultant Orthopaedic Surgeon, The Middlesex Hospital; Past President of the British Orthopaedic Association, The Orthopaedic Section of the Royal Society of Medicine, and the Orthopaedic Section of the British Medical Association; Corresponding Member, The American Orthopaedic Association; Formerly, Hunterian Professor, The Royal College of Surgeons of England; Lecturer in Orthopaedic Surgery, The University of London; Brigadier, Consultant Surgeon in the Army. A volume of 68 pages, with 519 illustrations. Published by Little, Brown & Co., Boston 6, Mass., 1960. Price \$7.50.

THE YEAR BOOK OF CANCER (1959-1960 YEAR BOOK SERIES). Compiled and edited by RANDOLPH LEE CLARK, JR., B.S., M.D., M.Sc. (Surgery), D.Sc. (Hon.), Houston, Texas, Director and Surgeon-in-Chief, The University of Texas M. D. Anderson Hospital and Tumor Institute; Professor of Surgery, The University of Texas Postgraduate School of Medicine; Clinical Professor of Surgery, Baylor University College of Medicine; Chairman, Committee on Cancer, American College of Surgeons; F.A.C.S., and RUSSELL W. CUMLEY, B.A., M.A., Ph.D., Houston, Texas, Director of Publications, the University of Texas M. D. Anderson Hospital and Tumor Institute; Professor of Medical Journalism, The University of Texas Postgraduate School of Medicine; Executive Editor, Medical Arts Publishing Foundation. A volume of 534 pages, with 172 figures. Published by the Year Book Publishers, Inc., Chicago 11, Ill., 1960. Price \$8.50.

LYMPHANGIOGRAPHIE UND LYMPHADENOGRAPHIE DER EXTREMITÄTEN. By Doz. Dr. FRITZ KAINDL, Dr. EVA MANNHEIMER, Dr. LILLY PFLEGER-SCHWARZ, and Doz. Dr. BRUNO THURNHER, Vienna. With a Foreword by Prof. Dr. K. Fellinger, Vienna. Fortschr. a. d. Geb. d. Röntgenstrahlen, Ergänzungsband 87. A volume of 72 pages, with 148 illustrations on 112 figures. Published by Georg Thieme, Herdweg 63, (14a) Stuttgart, Germany, 1960. Price DM 39.— (\$9.30); to subscribers to Fortschrifte, DM

35.10. Distributed in the United States and Canada by Intercontinental Medical Book Corporation, New York 16, N. Y.

STRAHLENGEFÄHRDUNG UND STRAHALENSCHUTZ IN DER ZAHNÄRZTLICHEN RÖNTGENDIAGNOSTIK. By Professor Dr. med. Dr. med. dent. THEODOR KIRSCH, Oberarzt an der Universitätsklinik und Poliklinik für Mund-, Zahn- und Kieferkranke in Heidelberg. A monograph of 60 pages, with 47 illustrations and 9 tables. Published by Dr. Alfred Huthig Verlag, Wilckensstrasse 3, Heidelberg, Germany, 1960. Price DM 6.80.

Book Reviews

DIE ASBESTOSE DER LUNGEN: GENESE—KLINIK—RÖNTGENOLOGIE. By DR. MED. H. BOHLIG, Lüdenscheid/Westf., DR. MED. G. JACOB, Karl-Marx-Stadt, and DR. MED. H. MÜLLER, Freital b. Dresden. Fortschr. a. d. Geb. d. Röntgenstrahlen, Ergänzungsband 85. A monograph of 166 pages, with 137 illustrations on 97 figures. Published by Georg Thieme, Herdweg 63, (14a) Stuttgart, Germany, 1960. Price DM 66.—(\$15.70); to subscribers to the Fortschritte, DM 59.40 (\$14.15). Distributed in the United States and Canada by Intercontinental Medical Book Corporation, New York 16, N. Y.

In this neat volume the authors present a complete analysis of our present day knowledge of asbestos. In the first chapters they describe the mining and processing of asbestos up to the finished manufactured product. The hazards at every phase of production are pointed out and suggestions for their prevention are offered. There follow discussions of the pathology, pathogenesis, clinical examination, diagnosis, prognosis, and therapy of asbestos based on a study of 716 proved cases. The roentgenology of the condition is presented in great detail and in a masterly manner. Sixty pages are devoted to this subject, with excellent illustrations. Special attention is given to the differential diagnosis.

Numerous statistical graphs supporting the authors' deductions are included. The world literature is extensively reviewed, and quotations from the most eminent writers on the subject are presented freely.

In the United States 19,700 workers are directly employed in the manufacture of asbestos products, but the number of those who handle the finished product and are exposed to some hazard is probably much larger. The book is thus a timely one. It will be of particular value to the radiologist and to the industrial surgeon. Since, however, little is recognized, yet significant hazards exist in the building trades (plumbers and steamfitters applying asbestos insulation), in the automobile industry (mechanics grinding and drilling asbestos brake bands), and in other fields, the volume should also be of considerable value to the general practitioner.

LES PANCRÉATITES CHRONIQUES DE L'ADULTE. By H. SARLES AND M. MERCADIER, with the collaboration of J.-Cl. SARLES, R. MURATORE, AND Cl. GUIEN. A volume of 266 pages, with 71 figures. Published by L'Expansion scientifique française, 15, rue St-Benoit, Paris VI^e, France, 1960. Price 36 NF.

The titles of the nine sections of this work on chronic pancreatitis probably best indicate its contents and scope: Physiology; Etiology and Pathogenesis; Pathological Anatomy; Clinical Study; Differential Diagnosis; Radiology; Functional Exploration (biochemical study); Medical Management; Surgical Treatment. Various radiological methods of examination are discussed: plain films for calcification; contrast demonstration of adjacent organs, as the stomach, duodenum, and gallbladder; retroperitoneal air insufflation, with anteroposterior, lateral, and transverse tomography; splenopertigraphy; operative pancreatography. One of the procedures used by the authors when the second, third, and fourth portions of the duodenum fail to fill in a routine upper gastrointestinal examination is "hypotonic duodenography." This consists in the injection of Probanthine intramuscularly to cause atony of the duodenum, following which barium is injected through a duodenal tube.

This book cannot be said to offer any new material from a radiological point of view, but it will serve as a useful atlas and review of methods available for study of the pancreas. The examples selected for illustrative purposes are good, as are the reproductions, particularly those of operative pancreatography.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Acting Secretary-Treasurer*, Robert P. Barden, M.D., 8835 Germantown Ave., Philadelphia 18, Penna.

AMERICAN RADIUM SOCIETY. *Secretary*, Charles C. Stetson, M.D., Englewood Hospital, Englewood, N. J. Next Annual Meeting, Colorado Springs, Colo., May 11-13, 1961.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, C. Allen Good, M.D., Mayo Clinic, Rochester, Minn.

AMERICAN COLLEGE OF RADIOLOGY. *Exec. Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6.

AMERICAN CLUB OF THERAPEUTIC RADIOLOGISTS. *Secretary*, Juan A. del Regato, M.D., 2200 North Cascade Ave., Colorado Springs, Colo.

ASSOCIATION OF UNIVERSITY RADIOLOGISTS. *Secretary-Treasurer*, Melvin M. Figley, M.D., 7010 51st Ave., N.E., Seattle, Wash.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, T. Leututia, M.D., 10 Peterboro, Detroit 1, Mich.

SOCIETY OF NUCLEAR MEDICINE. *Secretary*, Robert W. Lackey, M.D., 452 Metropolitan Bldg., Denver 2, Colo.

SOCIETY FOR PEDIATRIC RADIOLOGY. *Secretary-Treasurer*, Richard D. Lester, M.D., 412 Union St. S. E., Minneapolis 14, Minn. Next meeting, Sept. 26, 1960, Atlantic City, N. J.

Alabama

ALABAMA RADILOGICAL SOCIETY. *Secretary-Treasurer*, J. Garland Wood, Jr., M.D., Medical College of Alabama, Birmingham 3.

Arizona

ARIZONA RADILOGICAL SOCIETY. *Secretary-Treasurer*, Don E. Matthiesen, M.D., 926 E. McDowell Rd., Phoenix. Annual meeting with State Medical Association; interim meeting in December.

Arkansas

ARKANSAS RADILOGICAL SOCIETY. *Secretary-Treasurer*, J. B. Scruggs, M.D., 1700 W. 13th St., Little Rock. Meets quarterly.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, William H. Graham, M.D., 630 E. Santa Clara St., San Jose.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADILOGICAL SOCIETY. *Secretary*, Walter Stilson, M.D., 1720 Brooklyn Ave., Los Angeles 33. Meets second Wednesday, Septem-

ber, November, January, April, and June, Los Angeles County Medical Association Building.

NORTHERN CALIFORNIA RADILOGICAL SOCIETY. *Secretary*, Rob H. Kirkpatrick, M.D., 1219 28th St., Sacramento 16. Meets last Monday of each month, September through June.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with State Medical Association.

RADIOLOGICAL SOCIETY OF SOUTHERN CALIFORNIA. *Secretary*, Joseph F. Linsman, M.D., 436 N. Roxbury Dr., Beverly Hills.

REDWOOD EMPIRE RADILOGICAL SOCIETY. *Secretary*, Lee E. Titus, M.D., 164 W. Napa Street, Sonoma, Calif. Meets second Monday every other month.

SAN DIEGO RADILOGICAL SOCIETY. *Secretary*, Stanley A. Moore, M.D., 2466 First Ave., San Diego 1. Meets first Wednesday of each month.

SAN FRANCISCO RADILOGICAL SOCIETY. *Secretary-Treasurer*, Merrill A. Sisson, M.D., 450 Sutter St., San Francisco 8. Meets quarterly.

SOUTH BAY RADILOGICAL SOCIETY. *Secretary*, Stanford B. Rossiter, M.D., 1111 University Dr., Menlo Park. Meets second Wednesday every month.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, John H. Heald, M.D., 450 Sutter St., San Francisco 8. Meets third Thursday at 7:30 p.m., Children's Hospital, September through June.

Colorado

COLORADO RADILOGICAL SOCIETY. *Secretary*, Bertram L. Pear, M.D., 3 Winwood Dr., Englewood. Meets monthly, third Friday, at Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary-Treasurer*, Wayne P. Whitcomb, M.D., Hospital of St. Raphael, New Haven. Meets bimonthly, second Wednesday.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary-Treasurer*, William E. Sheely, M.D., 1746 K St., N.W., Washington 6. Meets third Wednesday, January, March, May, and October, in the Medical Society Library.

Eastern States

EASTERN RADILOGICAL SOCIETY. *Secretary-Treasurer*, John D. Osmond, Jr., M.D., 101 E. 185th St., Cleveland, Ohio.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary*, Alfred G. Levin, M.D., 837 DuPont Bldg., Miami.

FLORIDA WEST COAST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Joseph C. Rush, M.D., Mease Hospital, Dunedin. Meets quarterly at the Tampa Terrace Hotel.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Donald H. Altman, M.D., 2751 Coral Way, Miami. Meets monthly, third Wednesday, 8:00 P.M., at Jackson Memorial Hospital.

NORTH FLORIDA RADIOLOGICAL SOCIETY. *Secretary*, Paul A. Mori, M.D., 800 Miami Road, Jacksonville 7. Meets quarterly, March, June, September, and December.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Wilson T. Edenfield, M.D., 1026 Scott Circle, Decatur. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George W. Brown, M.D., 317 S. 8th St., Griffin, Ga. Meets in November and at the annual meeting of the State Medical Association.

RICHMOND COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Wm. F. Hamilton, Jr., M.D., University Hospital, Augusta. Meets first Thursday of each month.

Hawaii

RADIOLOGICAL SOCIETY OF HAWAII. *Secretary-Treasurer*, Philip S. Arthur, M.D., 274 Young Hotel Bldg. Meets third Monday of each month.

Idaho

IDAHO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Claude W. Barrick, M.D., St. Alphonsus Hospital, Boise. Meets in Spring and Fall.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary-Treasurer*, William F. Hutson, M.D., 5145 N. California Ave., Chicago 25. Meets at the Sheraton Hotel, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George A. Miller, M.D., Carle Hospital Clinic, Urbana. Spring and Fall meetings.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, William Meszaros, M.D., 1825 W. Harrison St., Chicago.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, David E. Wheeler, M.D., 1500 North Ritter, Indianapolis. Meets twice a year, first Sunday in May and during fall meeting of State Medical Association.

TRI-STATE RADIOLOGICAL SOCIETY (Southern Indiana, Northwestern Kentucky, Southeastern Illinois).

Secretary-Treasurer, James R. Mathews, M.D., 118 S. E. First St., Evansville, Ind. Meets October, January, March, and May.

Iowa

IOWA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, L. L. Maher, M.D., 1419 Woodland Ave., Des Moines 14. Meets during annual session of State Medical Society, and in the Fall.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Lewis G. Allen, M.D., 807 Huron Bldg., Kansas City, Kans. Meets in the Spring with the State Medical Society and in the Winter on call.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert H. Akers, M.D., VA Hospital, Louisville 2. Meets monthly, second Friday, at Seelbach Hotel, Louisville.

Louisiana

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets second Tuesday of each month.

RADIOLOGICAL SOCIETY OF LOUISIANA. *Secretary-Treasurer*, Robyn Hardy, M.D., 4324 Magnolia St., New Orleans 15.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, W. R. Harwell, M.D., 608 Travis St. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Albert A. Poulin, M.D., Thayer Hospital, Waterville. Meets in June, October, December, and April.

Maryland

MARYLAND RADIOLOGICAL SOCIETY. *Secretary*, Albert B. Shackman, M.D., 705 Medical Arts Bldg., Baltimore 1.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary-Treasurer*, Kenneth L. Krabbenhoft, M.D., 3825 Brush, Detroit 1. Meets first Thursday, October to May, Wayne County Medical Society rooms.

UPPER PENINSULA RADIOLOGICAL SOCIETY. *Secretary*, Arthur Gonty, M.D., Menominee. Meets quarterly.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Donald H. Peterson, M.D., 25 W. Fourth St., St. Paul 2. Meets Fall, Winter, and Spring.

Mississippi

MISSISSIPPI RADIOLOGICAL SOCIETY. *Secretary-Treas-*

urer, Bernard T. Hickman, M.D., University of Mississippi Medical Center, Jackson. Meets monthly, on third Thursday, 6:00 P.M., at Hotel Edwards, Jackson.

Missouri

GREATER ST. LOUIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Armand E. Brodeur, M.D., 35 N. Central Ave., Clayton 5, Mo. Meets on fourth Wednesday, October to May.

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, J. Stewart Whitmore, M.D., 1010 Rialto Bldg., Kansas City 6, Mo. Meets fourth Friday of each month October through May.

Montana

MONTANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. K. Boughn, M.D., 35-11th Ave., Helena. Meets annually.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Ronald E. Waggener, M.D., Nebraska Methodist Hospital, Omaha. Meets third Wednesday of each month at 6 P.M. in Omaha or Lincoln.

Nevada

NEVADA RADIOLOGICAL SOCIETY. *Corresponding Secretary*, Robert M. Taylor, M.D., 2020 W. Charleston Blvd., Las Vegas. Meets during annual session of State Medical Society.

New England

CONNECTICUT VALLEY RADIOLOGIC SOCIETY. *Secretary-Treasurer*, Paul J. Kingston, M.D., 114 Woodland St., Hartford, Conn. Meets second Friday of October and April.

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, Robert E. Wise, M.D., 605 Commonwealth Ave., Boston 15, Mass. Meets third Friday, October through May, Longwood Towers, Brookline, Mass.

New Hampshire

NEW HAMPSHIRE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Paul Y. Hasserjian, M.D., 1470 Elm St., Manchester. Meets three times a year.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Austin J. Tidaback, M.D., 912 Prospect Ave., Plainfield. Annual meeting in Spring, Atlantic City; Fall meeting October or November, Newark.

New York

BROOKLYN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Joseph P. Arcomano, M.D., 168 Clinton St., Brooklyn 1. Meets first Thursday of each month, October through May.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary*, Kenneth H. Seagrave, M.D., Buffalo Medical Group, 537

Delaware Ave., Buffalo 2. Meets second Monday, October to May.

CENTRAL NEW YORK RADIOLOGICAL SOCIETY. *Secretary*, Joseph A. Head, M.D., Hospital of the Good Shepherd, Syracuse University, Syracuse. Meets first Monday, October through May.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, C. P. Naidorf, M.D., 411 Parkside Ave., Brooklyn 26. Meets fourth Thursday, October to April (except December), at 9:00 P.M., Kings County Medical Bldg.

NASSAU RADIOLOGICAL SOCIETY. *Secretary*, Alan E. Baum, M.D., 100 Newbridge Road, Hicksville, N. Y. Meets second Tuesday, February, April, June, October, and December.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Albert A. Dunn, M.D., 428 W. 59th St., New York 19.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Lester I. Citren, M.D., St. Mary's Hospital, Troy. Meets in the capital area second Wednesday, October, November, March, and April; annual meeting, May or June.

RADIOLOGICAL SOCIETY OF STATE OF NEW YORK. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meets annually with the State Medical Society.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, Robert H. Greenlaw, M.D., 188 Irvington Road, Rochester 20. Meets last Monday of each month, September through May.

WESTCHESTER RADIOLOGICAL SOCIETY. *Secretary*, Richard P. Avonda, M.D., 212 Harwood Bldg., Scarsdale. Meets third Tuesday of January and October and as announced.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary-Treasurer*, Owen Doyle, M.D., 1015 Professional Village, Greensboro. Meets in spring and fall of each year.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, Richard F. Raasch, M.D., P.O. Box 990, Dickinson. Meets in the Spring with State Medical Association; in Fall or Winter on call.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary*, Paul D. Meyer, M.D., 6160 Cherry Hill Dr., Columbus. Next annual meeting, May 19-21, 1961, Deshler Hilton Hotel, Columbus.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert L. Friedman, M.D., Grant Hospital, Columbus 15. Meets second Thursday, October, November, January, March, and May, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Norman E. Berman, M.D., 14404 S. Park Blvd., Shaker Heights 20. Meets at 7:00 P.M., fourth Monday, October, November, January,

February, March, April, at Tudor Arms Hotel. **GREATER CINCINNATI RADIOLOGICAL SOCIETY.** *Secretary-Treasurer*, Stanley J. Lucas, M.D., Provident Bank Bldg., Cincinnati 2. Meets first Monday, September through May, at Cincinnati General Hospital.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, G. F. Johnson, M.D., 1030 Reibold Bldg., Dayton 2, Ohio. Meets monthly, second Thursday, Miami Valley Hospital, Dayton.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary*, E. D. Greenberger, M.D., Medical Arts Bldg., McAlester. Meets in January, May, and October.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George R. Satterwhite, M.D., 1123 S.W. Yamhill St., Portland. Meets monthly, second Wednesday, October to June, University Club, Portland.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John W. Burkey, M.D., 509 Olive Way, Seattle 1, Wash. Next annual meeting in Portland, Ore., May 1961.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Frederick R. Gilmore, M.D., Clearfield Hospital, Clearfield. Next annual meeting, Bedford Springs Hotel, May 26-27, 1961.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, Robert B. Funch, M.D., Germantown Hospital, Philadelphia 44. Meets first Thursday of each month at 5:00 P.M., from October to May, in Thompson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY. *Secretary*, Charles N. Chasler, M.D., Elizabeth Steel Magee Hospital, Pittsburgh 13. Meets monthly, second Wednesday, October through June.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John H. Freed, M.D., 4200 E. Ninth Ave., Denver 20, Colo. Next annual meeting, Denver Hilton Hotel, Denver, Colo., Aug. 10-12, 1961.

South Carolina

SOUTH CAROLINA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George W. Brunson, M.D., 1406 Gregg St., Columbia. Meets (primarily for business) in conjunction with South Carolina Medical Association in May. Scientific meeting in Fall.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Donald J. Peik, M.D., 303 S. Minnesota

Ave., Sioux Falls. Meets during annual meeting of State Medical Society.

The Southeast

SOUTHERN RADIOLOGICAL CONFERENCE. *Secretary-Treasurer*, Marshall Eskridge, M.D., 1252 Springhill Ave., Mobile, Ala.

The Southwest

SOUTHWESTERN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Ralph S. Clayton, M.D., 1501 Arizona Bldg. 2 A, El Paso, Tex. Meets monthly, last Friday, 6:30 P.M., Paso Del Norte Hotel, El Paso.

Tennessee

EAST TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frere, Jr., M.D., 205 Medical Arts Bldg., Knoxville. Meets in September and January, and prior to State Medical Association meeting.

MEMPHIS ROENTGEN SOCIETY. *Secretary-Treasurer*, Hollis H. Halford, M.D., Kennedy VA Hospital, Memphis 15. Meets monthly first Monday, John Gaston Hospital.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James J. Range, M.D., P.O. Box 324, Johnson City. Meets annually with State Medical Association in April.

Texas

CENTRAL TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Glenn Addison Stokdyk, M.D., VA Center, Temple. Meets monthly, fourth Monday, at Kosel's Cafe, Temple.

DALLAS-FORT WORTH RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. H. Neil, M.D., 1217 W. Cannon St., Fort Worth. Meets monthly, third Monday, 6:30 P.M., at the Greater Fort Worth International Airport.

HOUSTON RADIOLOGICAL SOCIETY. *Secretary*, Edward Singleton, M.D., 6621 Fannin St., Houston 25. Meets monthly, last Monday, at Doctors' Club.

SAN ANTONIO-MILITARY RADIOLOGICAL SOCIETY. *Secretary*, Hugo F. Elmendorf, Jr., M.D., 730 Medical Arts Bldg., San Antonio 5, Texas. Meets at Fort Sam Houston Officers' Club, third Wednesday of each month, 6:30 P.M.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 1216 Pennsylvania Ave., Fort Worth 4. Next meeting in Fort Worth, Jan. 20-21, 1961.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Richard Y. Card, M.D., St. Mark's Hospital, Salt Lake City 3. Meets third Wednesday, January, March, May, September, November.

Vermont

VERMONT RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Williams, M.D., 46 Nichols St., Rutland.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary, Frank A. Kearney, 2nd, M.D., 110 S. Curry St., Phoebus.*

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer, Joseph T. Houk, M.D., 14303 Ambaum Blvd., Seattle 66. Meets third Monday of each month, September to April, University of Washington Medical School.*

West Virginia

WEST VIRGINIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer, Karl J. Myers, M.D., Myers Clinic-Broadbudd Hospital, Philippi. Meets with State Medical Society, and as announced.*

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer, Joseph F. Wepfer, M.D., 5000 W. Chambers St., Milwaukee 10. Meets fourth Monday, October through May, at the University Club.*

SECTION ON RADIOLOGY, STATE MEDICAL SOCIETY OF WISCONSIN. *Secretary, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee 2. Meets in October with State Medical Society.*

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer, Howard G. Bayley, M.D., 124 Winn Terrace, Beaver Dam.*

Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary-Treasurer, Dr. César E. Rosa-Pérez, Fondo del Seguro del Estado, Parada 1, San Juan.*

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer, Robert G. Fraser, M.D.; As-*

sociate Honorary Secretary-Treasurer, Jean-Louis Leger, M.D. Central Office, 1555 Summerhill Ave., Montreal 25, Quebec. Meets in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTRO-RADIOLOGIE MÉDICALES. *General Secretary, Louis Ivan Vallée, M.D., Hôpital Saint-Luc, 1058 rue St-Denis, Montreal 18. Meets third Saturday of each month.*

L'ASSOCIATION DES RADIOLOGISTS DE LA PROVINCE DE QUÉBEC. *ASSOCIATION OF RADIOLISTS OF THE PROVINCE OF QUEBEC. Secretary, O. Raymond, M.D., 5400 Blvd. Gouin W., Montreal 9. Meets four times a year.*

MONTRÉAL RADIOLOGICAL STUDY CLUB. *Secretary-Treasurer, Fleming McConnell, M.D., 1650 Cedar Ave., Montreal, Que. Meets first Tuesday evening, October to April.*

TORONTO RADIOLOGICAL SOCIETY. *Secretary-Treasurer, L. R. Harnick, M.D., X-Ray Department, Toronto Western Hospital, 399 Bathurst St. Meets second Monday evening, September to May.*

CUBA

SOCIEDAD CUBANA DE RADIOLOGÍA Y FISIOTERAPIA. *Secretary, Dr. Miguel A. García Plasencia, Hospital Curie, 29 y F, Vedado, Havana. Meets monthly.*

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA. *Headquarters, Calle de Coahuila, Núm. 35, Mexico 7, D. F. Secretary General, Enrique Alvarez Hernández, M.D. Meets first Monday of each month.*

PANAMA

SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor, Luis Arrieta Sánchez, M.D., Apartado No. 86, Panama, R. de P.*



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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Paget's Disease of the Skull and Secondary Basilar Impression. J. W. D. Bull, W. L. B. Nixon, R. T. C. Pratt, and P. K. Robinson. *Brain* 82: 10-22, March 1959. (Institute of Neurology, Queen Square, London, England)

The authors studied the radiological changes in 64 patients with Paget's disease of the skull, particularly in relationship to the development of basilar impression and its frequent occurrence in this condition.

Of the 64 patients, 31 were male, with an average age, at examination, of sixty-two years, and 33 were female, with an average age of sixty-three years. On the lateral skull radiograph of each patient four measurements were made, namely, the basal angle α in degrees, the angle β in degrees, between the plane of the atlas and the plane of the hard palate, McGregor's measure m in millimeters (Brit. J. Radiol. 21: 171, 1948. Abst. in Radiology 52: 445, 1949), and Chamberlain's measure c in millimeters (Yale J. Biol. & Med. 11: 487, 1939). On the basis of the radiographic findings, each patient was allocated to one of six groups. Groups I-IV included all patients exhibiting the bone thickening characteristic of classical Paget's disease, graded according to severity; Group C comprised patients with osteoporosis circumscripta, and Group M patients exhibiting both types of bony change.

Basilar Impression: The 64 patients were classified as "normal" or "abnormal" with respect to basilar impression on the basis of the individual values of β , m , and c , according to the statistical criterion set forth in an earlier paper (Bull, Nixon, and Pratt: *Brain* 78: 229, 1955. Abst. in Radiology 66: 616, 1956). If any of the three values reached or exceeded the corresponding criterion values ($\beta = +13^\circ$, $m = +9$ mm., and $c = +7$ mm.), that patient was classified as "abnormal." Twenty patients were found to be abnormal. There was a tendency for the incidence of basilar impression to rise from Group I to Group IV; the incidence was low in the osteopetrosis group (Group C) and high in the mixed group (Group M). The tendency was relatively more marked among females.

Radiographic Measurements: The actual values of the various measurements on the skull radiographs were studied also for possible relationships to progress of the disease and severity of bony change. Eleven patients were seen and radiographed on more than one occasion over a period of years; 3 of these showed a definite increase in the degree of basilar impression as measured by values of the angle β . The authors believe that a discriminant measure, combining the value for McGregor's criterion with the value for the angle β between the plane of the atlas vertebra and the plane of the hard palate, serves as a better indicator of basilar impression than either of these measures taken alone.

Clinical Features of Neurological Involvement from Basilar Impression: A study of 4 cases in the present series with neurological involvement from basilar impression and of 11 cases from the literature showed that when neurological symptoms occur they are usually slow in developing. The history, as a rule, extends over one to five years, although it may be as short as three months or as long as twelve years. Basilar impression secondary to Paget's disease may produce neurological disturbance by compression and distortion of the

structures adjacent to the foramen magnum and of the contents of the posterior fossa and upper cervical spinal canal. This leads to a combination of lower cranial nerve, cerebellar, and upper cervical cord symptoms and signs. Invagination of the skull base with distortion of the fourth ventricle and aqueduct of Sylvius may give rise to increased intracranial pressure and to hydrocephalus. The diagnosis of the neurological complications of basilar impression may be straightforward, and analysis of the present series showed that those cases with neurological complications have a greater degree of basilar impression, as shown on the lateral radiograph, than those without. However, a considerable degree of basal deformity can exist without any disturbance of neurological function. As the bony deformity may be unassociated with neurological symptoms and signs, when the two occur together it must be decided whether they are causally related.

Sixteen roentgenograms; 3 charts and diagrams; 3 tables.

Occlusion of the Third Ventricle by Tortuous, Bulbous, Calcified Basilar Artery. Hendrik J. Sven and Luigi Peserico. *Neurology* 9: 836-838, December 1959. (Mayo Clinic, Rochester, Minn.)

A long basilar artery occasionally may cause an indentation in the bottom of the third ventricle, particularly if the elongated artery is rigid and tortuous as a result of arteriosclerosis. Greitz and Löfstedt (Acta radiol. 42: 85, 1954. Abst. in Radiology 64: 890, 1955) reported 5 cases of such deformation of the floor of the ventricle, and the authors present another.

A 59-year-old man was admitted to the Clinic because of marked mental disorientation. Several months earlier he had suffered what was called a "stroke." Except for a blood pressure of 210/170 mm. Hg, with an irregular pulse averaging 72 beats per minute, the general physical examination was essentially negative. It was thought unlikely that the mental condition of the patient was caused by drugs or by the hypertension in itself, and the possibility of some primary disturbance of the central nervous system was raised. Roentgenograms of the skull revealed a curvilinear strand of calcification above and slightly to the left of the sella turcica, with erosion of the left anterior clinoid process. Hypertensive narrowing, Grade 2, of the renal arterioles, with focal constrictions and sclerosis of Grade 2, and a small retinal hemorrhage were found. Ventriculography disclosed dilatation of the lateral ventricles caused by a partially calcified, space-occupying mass deforming the antero-inferior aspect of the third ventricle. The mass was in the midline and extended over to either side. These roentgen findings suggested an aneurysm, and consequently bilateral carotid arteriography was carried out. This indicated elevation of the carotid siphon on both sides by what appeared to be a mass projecting to each side of the midline in the sellar region; there was no evidence of cerebral aneurysm. It was felt that the patient might have a cystic lesion, possibly a craniopharyngioma, in the region of the third ventricle, and that this might be responsible for the symptoms. A right transfrontal craniotomy was performed, but nothing abnormal could be seen. It was concluded that, if a tumor were present, it was lying under the third ventricle, posterior to the chiasma, in a region inaccessible to surgery.

The patient died the day following operation. Necropsy examination made it apparent that a long, tortuous, dilated basilar artery had brought about elevation of the floor of the third ventricle and had produced the roentgenologic findings.

In the cases reported by Greitz and Löfstedt, the clinical and roentgenologic signs of advanced arteriosclerosis were present; the blood pressure was considerably increased, the systolic pressure ranging between 200 and 240 mm. Hg. In the authors' case, arteriosclerosis of the basilar artery was a prominent feature and the blood pressure, as noted above, was 210/170.

The indentation produced on the floor of the third ventricle by an ectatic basilar artery must be distinguished from the impression caused by tumors of the brain stem, tumors arising from the sella turcica, or aneurysms. In such a situation, vertebral angiography is the best form of investigation; it is associated with considerable risk, however, in patients who have a basilar artery affected by arteriosclerotic changes.

Four roentgenograms.

Autotomography of the Fourth Ventricle and the Floor of the Third Ventricle. J. Schvarc. *Acta radiol.* 52: 465-469, December 1959. (Serafimerlasarettet, Stockholm, Sweden)

The author describes a method of tomography which helps to delineate the air-filled fourth ventricle, aqueduct, and floor of the third ventricle, without interference by overlying and superimposed air in the mastoid cells or air in the basal cisterns during lumbar pneumoencephalography.

The patient is positioned as for lumbar encephalography, in a specially constructed chair with the head supported by a cushion suspended on a vertical skull stand. When injected air is identified in the ventricular system, the head is rotated manually on the axis of the odontoid process, either by the patient himself or by an assistant with the aid of gauze strips. An autotomographic lateral view is taken after injection of 5 ml. of air, with an exposure time of 2.5 to 3 seconds.

Six roentgenograms; 1 photograph.

JOHN P. FOTOPOULOS, M.D.

Northwestern University Medical School

Visualization of the Posterior Cerebral Artery by Injection of the Carotid Artery. N. Martinez, Jean-Léger, Denise Ouimet, and Claude Bertrand. *J. Canad. A. Radiologists* 10: 51-55, December 1959. (In French) (Hôpital Notre-Dame, Montreal, P. Q., Canada)

The radiologist should be well acquainted with the radiographic projection of the posterior cerebral artery, as this vessel nourishes a rather important segment of the brain. When in an abnormal position, it may indicate a temporal lobe herniation, often caused by a supratentorial expanding lesion.

The authors cite their experience with 332 carotid arteriographic studies, with injection of the common carotid in 150, the external carotid in 12, and the internal carotid in 170.

The posterior cerebral artery is visualized in only 20 to 24 per cent of the cases when the examination is done by way of the common carotid. This percentage rises to 75 to 80 per cent when the internal carotid artery is punctured. These findings are similar to those of Lindgren, who obtained opacification of the posterior cerebral artery in two-thirds of his cases when the in-

jection was done in the internal carotid (*Acta radiol. Suppl.* 151, 1957. *Abst. in Radiology* 71: 599, 1958).

It seems clear that the visualization of the posterior cerebral artery is dependent, in a great majority of the cases, on a technic which calls for injection of the internal carotid artery. Failure to visualize the posterior cerebral artery, which may occur in one-fifth of the cases, can be explained in part by perivascular injection. The hypothesis that the filling of the artery can be explained by intracranial hypotension created by the stimulation of the carotid sinus is, according to the authors, of secondary importance.

Four roentgenograms; 1 table.

PETER TORBEY, M. D.
University of Missouri

Variations in the Striate and Other Cerebral Veins Affecting Measurements of the "Venous Angle." B. Albert Ring. *Acta radiol.* 52: 433-447, December 1959. (Serafimerlasarettet, Stockholm, Sweden)

With the recognition of the importance of venous as well as arterial displacement in cerebral angiographic diagnosis, the curve of the striate vein (striothalamic) as it passes through the foramen of Monro to join the septal vein has gained significance. This has been called the "venous angle," and many investigators have devised methods of measuring its position for the determination of pathologic displacement. The original purpose of the present paper was to evaluate the method of Laine and others (*Acta radiol.* 46: 203, 1956. *Abst. in Radiology* 68: 757, 1957).

Laine's method calls for a straight line from the junction of the straight sinus and vein of Galen to the limbus sphenoidalis, the normal venous angle then falling in a triangular area 14 X 7 mm., with the apex anteriorly. Because of difficulty in determining the exact point of reference at the junction of the vein of Galen and the straight sinus, the author developed a modification of Laine's technic. The most posterior point of the posterior callosal vein was chosen as the point of reference and from this a line was drawn to the limbus sphenoidalis. In 73 of 100 normal cases, the venous angle fell in an oval area of about 6 X 8 mm. While this means that the percentage of false positives would be 27, that figure is significantly less than the 45 per cent obtained with Laine's original technic.

In a significant number of cases, the striate vein and the true venous angle are not seen, 19 per cent in this series. When the striate vein is not visible, a tributary appears to replace it, forming a false venous angle. The following criteria are given for recognition of this false angle: (1) absence of the ascending portion of the internal cerebral vein with the venous angle located too far posteriorly; (2) a "dot" on the tributary forming the false venous angle which marks the lateral entrance of the caudate vein; (3) loss of the smooth curve of the striate; (4) entrance of the tributary vein into the internal cerebral at a right angle; (5) unusually long tributaries running back from the region of the anterior horn in association with a posterior position of the false venous angle.

In evaluating 96 patients with brain tumors, the author's modification of Laine's method showed satisfactory measurements in 74 cases. All tumors in the frontal area including those in the sellar and suprasellar region gave satisfactory measurements. Parietal and temporal tumors had the highest failure rate, with central tumors being intermediate.

It is recommended that the original article be studied for the detailed derivation of the methods described and for a full-size reproduction of the template used in measurement.

Five figures, including 2 roentgenograms; 1 table.

JOHN P. FOTOPOULOS, M.D.

Northwestern University Medical School

A Case of Multiple Myeloma Presenting Clinically as a Solitary Tumor of the Skull. J. M. Hoffman and H. van Z. de Klerk. *South African M. J.* **33**: 1083-1084, Dec. 19, 1959. (Livingstone Hospital, Port Elizabeth, Union of South Africa)

A case of histologically proved multiple myeloma (plasmacytoma) in a 49-year-old Bantu woman, presenting as a solitary tumor of the skull, is reported. On examination, a swelling was apparent over the left parieto-occipital area, measuring 4 × 6 inches, irregularly lobulated, and for the most part of the consistency of soft rubber. A plaque of bone was palpable in the center, and there were defects in the skull margin at the edge. The roentgen picture was considered bizarre in that it showed a large, irregular osteolytic area with scalloped edges, containing some osteosclerotic areas, complete erosion of the inner table of the skull, and elevation of plaques of the outer table. Cerebral arteriograms revealed no evidence of excessive vascularization or intracranial shift. Small osteolytic areas were observed in the vertebrae and pelvis.

Other large skull defects associated with soft-tissue swellings should be differentiated from this condition. These include bone tumors proper; cholesteatoma; endocrinopathies; deficiency states (osteomalacia, osteoporosis); rare diseases such as disorders of marrow constituents or of endochondral ossification, and mesenchymal defects; and meningioma. In only two skull conditions, *viz.*, cholesteatoma and meningioma, are scalloped edges encountered with any frequency.

Two roentgenograms; 2 photographs.

Facial Paralysis Associated with Osteopetrosis (Marble Bones). Report of a Case of the Syndrome Occurring in Five Generations of the Same Family. Norman T. Welford. *J. Pediat.* **55**: 67-72, July 1959. (47 6th Ave., La Grange, Ill.)

As far as can be determined facial paralysis associated with petrosis (marble bones) has not been recorded previously. The author reports the occurrence of this syndrome in an 11-year-old boy and in 13 other males in five generations of the same family. In all, the facial paralysis developed at about the same age.

The patient was seen twenty-four hours after the onset of the facial paralysis. Examination showed weakness of the orbicularis oculi muscle on the right, with inability to close the right eye completely. There was a mask-like expression of the right side of the face. The corner of the mouth was deviated to the left during smiling, giving the characteristic appearance of a seventh cranial nerve paralysis on the right. The remaining cranial nerves were intact. Reflexes were normal throughout. Roentgen studies of the long bones, pelvis, spine, and skull revealed markedly increased thickness of the cortex typical of osteopetrosis. The density of the skull was increased, especially in the petrous portion of the temporal bone. Similar bone changes were found in roentgenograms taken of the patient's father and eight-year-old brother. Special roentgenograms of the mastoid region disclosed en-

croachment by thickened bone on the seventh nerve as it passed through the stylomastoid foramen on the right.

The author suggests that, when the underlying cause of facial paralysis in a child seems obscure, the possibility of osteopetrosis be considered.

Six roentgenograms; 1 photograph; 1 chart.

Fatal Granulomatosis of the Respiratory Tract (Lethal Midline Granuloma-Wegener's Granulomatosis). Irving M. Blatt, Holbrook S. Seltzer, Philip Rubin, A. C. Furstenberg, James H. Maxwell, and William J. Schull. *Arch. Otolaryng.* **70**: 707-757, December 1959. (Hauser Clinic, 7411 3d Ave., Ann Arbor, Mich.)

Data from 124 cases of lethal midline granulomatosis-Wegener's granulomatosis are presented—112 cases from the medical literature from 1897 to 1957 and 12 from the University of Michigan Medical Center. There were 82 males and 42 females in the series. The average age at diagnosis in the males was 42.9 years and in females 38.8 years. Two patients were Negroes; the rest were of the white race.

Fatal granulomatosis of the respiratory tract is a febrile inflammatory illness, characterized by a progressively destructive granulomatous suppuration of the upper respiratory tract and adjacent tissues of the face, usually with manifestations of disseminated systemic necrotizing granulomatous angiitis. There may be laryngeal and bronchopulmonary granulomas. The outcome is invariably fatal, as a result of renal failure, overwhelming infection, inanition, uncontrollable hemorrhage, or peripheral vascular collapse.

Two main forms of the disease are recognized—localized and generalized. The rhinopharyngological condition described by Stewart (J. Laryng. & Otol. **48**: 657, 1933) comprises the localized form (lethal midline granuloma) and the rhinopharyngological-systemic syndrome described by Klinger (Frankfurt Ztschr. f. Path. **42**: 455, 1931) and Wegener (Verhandl. deutsch. Path. Gesellsch. **29**: 202, 1936) the generalized form. The symptomatology may be divided into two stages: the premonitory, or prodromal, stage and the period of active disease, from which there is usually no return to health. *The common denominator is onset of disease in the upper respiratory tract.*

The *prodromal stage* may last from months to years. At first the patient may be conscious of nasal stuffiness or obstruction. Then there is a persistent nasal discharge, serous or mucoid at the onset and sanguinopurulent later. The initial expression in some patients may be a blister or ulcer in the center of the hard palate or on the tonsils. Symptoms may be continuous or episodic, with evidence of healing, only to be followed by recurrence.

Necrosis of integument, cartilage, or bone in the mid-facial-nasal area usually heralds the *period of active disease*. With extensive septal cartilaginous and bony destruction a saddle nose deformity may appear. The turbinates and nasal bones may also be destroyed. There is a progression of the mutilating gangrenous destruction to involve the maxillary and ethmoid sinuses and bones of the facial skeleton, with periodic elimination of sequestra. The final picture is that of loss of the midface. Ulceronecrotic granulomatous lesions are frequently seen in the larynx and trachea. Airway obstruction as a result of suppuration, hemorrhage, and accumulated necrotic tissue can occasionally lead to death. A chest roentgenogram frequently

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reveals nonspecific parenchymal infiltrations or nodular densities with excavation which suggest neoplasm or tuberculosis. Any part of the lung may be involved.

The lesions of fatal respiratory tract granulomatosis are not limited to the respiratory tract. Systemic involvement is the rule rather than the exception, although in a substantial proportion of cases it is an autopsy finding.

The roentgen picture in the prodromal stage or in the early period of active disease parallels the clinical manifestations. When the disease is unilateral in origin and granulomatous lesions can be seen in the nose, there invariably is roentgen evidence of paranasal sinus inflammation. Maxillary sinus involvement is the most frequent and the first to be detected roentgenographically, whether by primary extension or by ostium obstruction from granulation tissue in the nose. As the lesion progresses, bilateral maxillary sinus disease develops. The air-fluid level seen in acute sinusitis has not been encountered in these cases. The ethmoid, frontal, and sphenoid sinuses may also be involved in that order of frequency, and usually to less degree than the maxillary sinuses.

Bone destruction can usually be observed roentgenographically, concomitant with perforation of the cartilaginous nasal septum. The earliest sites of destruction seem to be the perpendicular plate of the ethmoid, the vomer, and the inferior and middle turbinates. Erosion of these bony components of the nasal septum may be difficult to detect by ordinary roentgen technics, however, unless the bony structure is widely destroyed. Absence of the turbinates is readily apparent, since they stand out in great contrast against the air-filled nasal cavity. Evidence of such bone destruction was present in 9 of the authors' own cases. As the destructive midfacial process continues, thinning and eventual obliteration of the medial wall of the maxillary sinus will be noted. The Caldwell projection is preferred to the Waters or Granger views, since the bones of the nasal chamber are shown in greater detail. A lateral view is of value for demonstrating sequestered bone.

Some of the limitations of routine roentgen procedures for study of the paranasal sinuses can be overcome by tomography or laminagraphy.

The roentgen appearance of the pulmonary lesions of fatal granulomatosis of the respiratory tract run almost the entire gamut of possible changes in pulmonary diseases and therefore are not diagnostic *per se*. Early, the widespread vasculitis of pulmonary vessels (seen histologically in the authors' cases and in those recorded in the literature) is characterized roentgenographically by increased pulmonary markings or as a soft interstitial pneumonitis. As the disease progresses, the picture may change to that of a fleeting patchy bronchopneumonia or to a diffuse miliary nodularity. One of the most intriguing manifestations of this bizarre disease (described in the literature and occurring in 3 cases of the present series) is the development of asymptomatic and clinically unrecognizable nodular densities which simulate metastatic neoplasms in their smooth, round shape. They appear suddenly, grow rapidly, and may undergo central necrosis and cavitation.

Renal involvement was not detected roentgenologically in the authors' cases, nor in any of the cases from the literature. If the gastrointestinal tract is affected, the small-bowel mucosal pattern is coarsened and segmented, as in nutritional deficiency states.

Surgical intervention appears to increase the mor-

bidity and intensity of the ulceronecrotic destructive process in the midfacial and other areas of the body, thereby creating deformities shocking to behold. When adrenal steroids are given, the patients are apparently spared the frightful destruction of bone and soft tissue, particularly in the facial area, so that the face remains intact. The antibacterial activity of the antibiotic drugs has been invaluable in eliminating secondary invaders. X-ray and radium therapy have not permanently arrested the disease process.

The pathogenesis of fatal granulomatosis of the respiratory tract is discussed. It is suggested that it represents a hypersensitivity reaction evoked by an autoantigen-antibody mechanism.

Twenty figures (8 roentgenograms); 13 tables.

The Cervical Spinal Canal in Syringomyelia. C. E. C. Wells, John D. Spillane, and A. S. Bligh. *Brain* 82: 23-40, March 1959. (Department of Neurology, Cardiff Royal Infirmary, Cardiff, Wales)

The results of a systematic radiologic investigation of the cervical spinal canal in 32 cases in which a clinical syndrome of syringomyelia was found are presented. Standard lateral projections were made with the patient in the erect position and with a tube-to-film distance of 6 ft.; for the anteroposterior projections the tube-to-film distance was 3 ft. The sagittal diameter of the spinal canal was measured in millimeters opposite each vertebra in the manner of Boijesen (*Acta radiol.* 42: 101, 1954. *Abst. in Radiology* 64: 902, 1955), namely, from the middle of the posterior surface of the body of the vertebra to the nearest point on the line of cortex seen at the junction of spinous process and laminae. Tomography and opaque myelography were also employed in the investigation of the majority of patients but, in view of the considerable and necessary variations in technic, measurements were not made on these films.

The sagittal diameter of the canal was found to be greater than normal (20 mm. or more) in 15 of the 32 cases. In none was there any localized area of erosion of pedicle or lamina. In 2 cases scalloping of the posterior surfaces of the vertebral body was seen. The size, shape, and architecture of the cervical vertebrae were otherwise normal. In 17 of the 32 cases, the onset of symptoms began before the age of thirty; in 14 of these, the spinal canal was wider than normal.

Three causes of widening of the canal are considered: erosion, an associated bony anomaly, and adaptation to the unusual girth of the syringomyelic cord. The evidence suggests that adaptation during growth of the canal was the main factor. The unusual appearance of the vertebrae in 2 cases suggests that there may sometimes be an associated developmental abnormality.

The finding of an abnormally wide cervical spinal canal in these 15 cases is taken as further evidence of the developmental origin of syringomyelia.

Fifteen figures, with 10 roentgenograms; 3 tables.

THE CHEST

Contribution to the Diagnosis and Frequency of Congenital Lung Aplasia. Th. Hülshoff and H. Kalvelage. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 91: 725-728, December 1959. (In German) (Knappschafts-Krankenhaus, Gelsenkirchen, Germany)

Congenital absence of a lung was formerly considered quite rare; up to 1950 the condition was recognized

only three times during life. In the following five years, however, almost one hundred cases appeared in the literature. Among 30,000 chest examinations during a three-year period the authors encountered this anomaly three times.

It is believed that cases usually are treated under the erroneous impression of pleural thickening and fibrothorax. Actually, all 3 of the authors' patients were referred with that diagnosis. One had spent considerable time in a tuberculous sanatorium thirty years previously. Another had received annuities for many years as a "tuberculosis suspect."

There usually is a marked discrepancy between the symptoms and roentgen findings. In spite of gross changes on roentgenograms of the chest, the patient may give a history of having performed heavy manual labor for years without untoward effects. At an advanced age, however, signs of cardiopulmonary insufficiency are bound to become manifest.

The most prominent roentgenologic sign is marked asymmetry of the thoracic cage, with retraction of the affected side. The space left empty by the aplastic lung appears opaque, as it is occupied by a shifted mediastinum, an elevated hemidiaphragm, and the herniated contralateral lung. The latter also shows compensatory emphysema. Grid films and tomograms reveal radiolucent areas due to the rudimentary main bronchus. On the left side gas formation in the elevated stomach and intestine may also be seen in the chest cavity. Lateral roentgenograms usually show aeration throughout, due to the herniated lung. Complete absence of calcifications and of chronic pleuropulmonary lesions directs attention to the possibility of congenital absence of a lung. Bronchoscopy and bronchography, however, are essential to establish a correct diagnosis. The latter method will demonstrate a blind ending of the main bronchus on the affected side.

In the differential diagnosis, shrinking processes such as pleural thickening, atelectasis, and unresolved pneumonia must be excluded.

Four roentgenograms. ERNEST KRAFT, M.D.
Northport, N. Y.

Ampullary Bronchiectases, a Rare Malformation of the Bronchi. W. Müller and K. Musshoff. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 91: 701-708, December 1959. (In German) (Medizinische Universitätsklinik, Freiburg i. Br., Germany)

The authors report 3 cases of ampullary bronchiectasis in adults, which they believe to be of congenital origin.

The first patient was a 34-year-old woman with a history of frequently recurring attacks of pneumonia since the age of six months, and with arthritic changes in the hands for the past ten years. Chest films showed increased pulmonary markings in the middle and lower lung fields. Bronchography revealed ampullary bronchiectasis extending to the peripheral subsegmental bronchi bilaterally, but involving predominantly the larger bronchi. There were also cylindric bronchiectases in both lower lobes.

The second patient, a man of 41, had had pneumonia at the age of twenty. More recent symptoms were cough, expectoration on arising, and loss of appetite and weight. The chest film showed ring formations in the right upper lobe and apex. Bronchography revealed ampullary dilatations in the left-lower-lobe subsegmental bronchi of the first, second, and third

order, but not in the periphery. In the right upper lobe, there was cystic dilatation of bronchi and chronic deforming bronchitis. The findings were attributed to bronchiectasis and honeycomb lung.

The third patient, a 44-year-old woman, gave a history of recurrent pneumonia for several years. The chest film showed cystic radiolucencies in areas of bronchopneumonic infiltration. Bronchography revealed multiple cysts throughout the left lung and in the right upper lobe, as well as cylindric and saccular bronchiectases in the left lower lobe and ampullary changes in the right upper lobe.

Acquired bronchiectasis usually is of the cylindric or saccular type. It involves the periphery of the lungs and produces the bronchographic appearance of a "leafless tree" with absence of alveolar filling. In the congenital type, the periphery is clear. The ampullary and varicose changes are located in the larger, more proximal bronchial segments. The ampullary formations tend to retain secretions, which causes delay of bronchial drainage. Development of secondary bronchiectases is therefore not surprising, especially in the basal segments, where postural drainage is impaired.

Form and localization of the ampullae suggest a congenital origin with a primary weakening of the bronchial walls. The occurrence of associated malformations elsewhere supports the congenital nature of the condition.

Eight roentgenograms.

Mass Photofluorography: An Analysis of Its Use for Detection of Lung Cancer. Harry Allen and Irvin Franzen. *J. Kansas M. Soc.* 60: 533-536, December 1959. (Kansas State Board of Health, Topeka, Kans.)

During the seven years prior to this report, the Kansas State Board of Health sponsored state-wide photofluorographic chest surveys as a means of detecting unsuspected cases of lung cancer as well as other chest diseases. Lack of funds and personnel, however, made it impossible to conduct an organized follow-up of the suspected cases. In order to formulate recommendations concerning the feasibility of the use of such surveys for detection of lung cancer and development of effective follow-up procedures, the authors present an analysis of one year (1957) experience.

During the year approximately 198,877 persons took advantage of the chest x-ray service, and in 210 of these (10.6 per 10,000 films) lung cancer was suspected. Thirty-five cases were confirmed by the Cancer Registry; 3 cases were considered malignant by private physicians but were not verified by the Registry; 82 cases were reported as nonmalignant by both the patient's physician and the Registry; 90 cases were not followed. Seven of 13 patients with bronchogenic carcinoma died within a year.

It is concluded that screening for cancer by mass photofluorography should be continued only if there are provisions for follow-up of suspected cases. The case-finding rate is low and actually, by the time the cancer can be demonstrated on the film, it is probably incurable. Nevertheless, the authors believe there is a moral obligation to continue mass surveys in the hope of early discovery and adequate medical supervision. Recommendations are made that a follow-up of suspected cancer cases be provided efficiently and economically by use of the Cancer Registry, follow-up correspondence with local doctors, and possibly by district

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public health nurses; that the screening be on a selective population basis, being limited to persons smoking more than two packages of cigarettes daily, those whose work entails inhalation of coal tar or its derivatives, and those who drive daily for rather long periods in crowded city traffic, inhaling air heavily polluted with automobile exhaust gases.

In an Addendum, the authors note that a similar analysis of the 1958 photofluorographic survey showed that, through the cooperation of local physicians, follow-up information on 82 per cent of all suspected cases was obtained.

Four tables.

Expedited Evaluation of Circumscribed Pulmonary Shadows. Allen E. Greer, John M. Carey, and Nazih Zuhdi. *J.A.M.A.* 171: 1783-1786, Nov. 28, 1959. (430 N. W. 12th St., Oklahoma City, Okla.)

Eighty-five patients whose chest films revealed peripheral solitary pulmonary nodules were subjected to thoracotomy. All were asymptomatic and the nodules showed either minimal or no calcification.

Forty-three of the lesions proved to be neoplastic, 30 being primary pulmonary carcinoma. Sixty-two lesions were in patients under sixty years of age and 39 per cent of these were malignant; 23 were in patients over sixty, and 57 per cent of this number were malignant.

In view of the unreliability of other diagnostic procedures, early surgery is recommended in the presence of a solitary circumscribed pulmonary shadow.

Four roentgenograms; 2 tables.

RICHARD H. GREENSPAN, M. D.
New Haven, Conn.

Primary Lymphosarcoma of the Lung. Emmett R. Hall, Jr., and Brian Blades. *Dis. of Chest* 36: 571-578, December 1959. (George Washington University School of Medicine, Washington, D. C.)

The authors give the histories of 3 cases of primary lymphosarcoma of the lung and tabulate the significant findings in 27 cases from the literature. This is a rare tumor and, like other lymphomas, is of unknown etiology. When symptoms are present, they are usually those of a pneumonic process, consisting of fatigue, cough, fever, dyspnea on exertion, chest pain, weight loss, and occasionally hemoptysis. The x-ray findings are not characteristic. Usually the appearance is that of a pneumonia involving either a lobe or an entire lung; at times there are discrete solitary lesions. A positive diagnosis in general requires thoracotomy and biopsy, though in 2 of the cases from the literature cytological examination of bronchial washings showed malignant cells.

Resection seems to be the treatment of choice. Of the 30 cases, 22 were amenable to excisional therapy: pneumonectomy in 12 and lobectomy in 10. Roentgen therapy was used as an adjunct in 8 cases.

Two roentgenograms; 2 photographs; 1 table.

HENRY K. TAYLOR, M. D.
New York, N. Y.

Respiratory Disease of Mushroom Workers: Farmer's Lung. Louis S. Bringhurst, Robert N. Byrne, and Jacob Gershon-Cohen. *J.A.M.A.* 171: 15-18, Sept. 5, 1959. (Chester County Hospital, West Chester, Penna.)

During the past two years 16 cases of respiratory disease were encountered among migrant Puerto Rican

workers in the mushroom industry in and around Chester County, Penna. The etiology of the disease is unknown, but symptoms arise during the bedding down or cleaning out of damp compost beds which contain moldy hay and silage, among many other organic products. A prompt response seems to develop following exposure, and this, if sufficiently intense, may lead to dyspnea, nausea, vomiting, pain, cough, sputum, fever, tachycardia, and prostration. The symptoms subside with removal of the patient from contact with the agent, but recur with re-exposure.

The roentgen appearance of the lungs suggests widespread diffuse infiltrations. Isolated lesions, when seen, are small, irregular in outline, and occasionally confluent. Resolution is rapid in the acute stages; increased fibrosis is encountered in the chronic stage.

The clinical and radiographic findings in this group of cases are similar to those of farmer's lung, where it is presumed that the offending agent in moldy hay is either a fungus, spores, or other organic components. In many respects the picture also resembles silo-filler's disease, in which the hazard is thought to originate from certain gases, especially nitrogen dioxide, liberated in recently filled silos.

Four roentgenograms; 1 table.

Idiopathic Pulmonary Hemorrhage in Pregnancy: Report of a Case Suggesting Early Pulmonary Hemosiderosis with Clinical Recovery After Steroid Therapy. Victor Gurewich and Martin A. Thomas. *New England J. Med.* 261: 1154-1159, Dec. 3, 1959. (MacDill Air Force Base, Tampa, Fla.)

Idiopathic pulmonary hemosiderosis should really be called idiopathic pulmonary hemorrhage, since the hemosiderosis and fibrosis found in the lungs result from repeated hemorrhages of unknown cause. Some type of auto-immune mechanism seems to be involved. The condition is quite rare, the present case being the seventh to be reported in an adult.

The common roentgen picture is one of blotchy infiltration, usually resolving rapidly, possibly recurring in multiple areas, with eventual development of a reticular pattern of fibrosis.

Clinically there are cough, hemoptysis, and anemia without obvious cause. Most cases are recurrent, with eventual death in an acute episode or from cor pulmonale. In the authors' case there was only one episode, occurring in the last trimester of pregnancy, and complete remission followed steroid therapy. Lung biopsy showed changes consistent with the early stage of the disease.

Five roentgenograms. ZAC F. ENDRESS, M. D.
Bloomfield Hills, Mich.

Radiologic Contributions to the Diagnosis of Histoplasmosis. Enrique Schwarz. *J.A.M.A.* 170: 2171-2174, Aug. 29, 1959. (840 S. Wood St., Chicago 12, Ill.)

Seventy-five children with positive histoplasmin tests and negative tuberculin tests were the object of a study designed to identify symptoms and findings which might be useful in the diagnosis of histoplasmosis. Half of the children exhibited symptoms of acute respiratory infection. In 12 the only symptoms were gastrointestinal.

Chest films of 67 patients were available. Definite signs of parenchymal disease in various patterns were found in 22; associated hilar adenopathy occurred in 7

and appeared as a single manifestation in 19. Intrathoracic calcifications of varied appearance were demonstrable in 43 patients, more commonly in the hilar and perihilar regions. Miliary calcium deposits in the lungs was found in 3 instances. No splenic calcifications were observed. The possibility of histoplasmosis was mentioned in 12 radiographic reports.

The role of the roentgenologist is important in the recognition of this disease in the early stage, especially since five years or more may be required for calcified lesions to show on the roentgenogram. Confirmation of the diagnosis cannot always be obtained by isolation of the fungus, as *Histoplasma capsulatum* may no longer be detected in the lung and lymph node regions five months after the infection. In patients with positive reactions to histoplasmin combined with negative tuberculin tests, the presence of an isolated lung infiltrate or miliary involvement with hilar adenopathy should suggest the diagnosis. When tuberculosis and other fungus infections can be excluded, a large granulomatous lesion in the lung could be an indication of the disease, although this may not be confirmed without surgical intervention. Patients in whom the so-called middle-lobe syndrome has developed, with healing of infected hilar nodes by fibrosis and calcification constricting a bronchus, may have negative reactions to cultures and microscopic examinations for fungus, even though their disease is caused by *Histoplasma*. An acute episode with fresh lung infiltrates visualized at the same time as lung calcifications may possibly indicate recurrence. Broncholiths have been referred to as an occasional complication.

Six roentgenograms; 2 tables.

Pulmonary Involvement in Leukemia. Robert A. Green and Norman J. Nichols. Am. Rev. Resp. Dis. 80: 833-844, December 1959. (N. J. N., VA Hospital, Bronx, N. Y.)

A correlative study of autopsy protocols, roentgenographic reports and roentgenograms, and summaries of clinical records was done in a total of 109 cases of leukemia available for review. Some leukemic involvement of the lungs or pleura was present in 27 per cent, but in most of these the lesions were microscopic. They were clinically significant in only 7 per cent.

Pulmonary parenchymal involvement was of two types, a diffuse interstitial and a nodular form. Non-parenchymal disease was more common and occurred as bronchial and peribronchial infiltrates, perivasculär infiltrates, and pleural and subpleural involvement. Pulmonary infarction was found in 3 patients in whom there was no heart disease or peripheral thrombotic phenomena.

Pulmonary infiltrations visible roentgenographically were found in 21 patients but in only 2 of these were they caused by leukemia. Infection was present in 10, and other causes such as hemorrhage, congestion, fibrosis, and infarction were responsible in 9. In many of these patients the infection did not respond to antimicrobial therapy in the usual manner. The persistence of pulmonary infiltrates despite antimicrobial treatment does not, therefore, necessarily indicate that the disease is not inflammatory. Pleural involvement was found to be of leukemic origin more frequently than the parenchymal infiltrates. Of 11 patients with roentgen evidence of pleural disease or effusion, leukemia caused the lesions in 5, while infection was the cause in 4, infarction in 1, and heart failure in the other.

The 27 per cent incidence of leukemic disease of the lungs in this series compares with that reported by other authors, but this refers to histopathologic rather than the clinical and roentgenographic incidence. In contrast, as pointed out above, the involvement was of clinical significance in only 7 per cent. Clinically significant lesions were more common in the chronic leukemias, occurring in 10 per cent of patients having that type of disease as against 4 per cent in acute leukemia. A more notable difference was found between chronic lymphatic leukemia and chronic myelogenous leukemia. Seventeen per cent of the patients with chronic lymphatic leukemia had significant pulmonary involvement, and in addition the problem of pleural effusion occurred predominantly in these patients. Clinically significant involvement was found in only 3 per cent of the patients with myelogenous leukemia.

Two roentgenograms; 3 photomicrographs; 1 photograph; 4 tables. JOHN H. JUHL, M.D. University of Wisconsin

The Pleural and Pulmonary Complications of Rheumatoid Arthritis. A. R. Horler and Malcolm Thompson. Ann. Int. Med. 51: 1179-1203, December 1959. (Royal Victoria Infirmary, G. P. O. Box No. 141, Newcastle-upon-Tyne 1, England)

The authors discuss the general incidence of pulmonary complications in rheumatoid arthritis and recount in detail 10 cases from the Royal Victoria Infirmary. These 10 patients were found among 180 with rheumatoid arthritis seen at this institution in a two-year period. Nine had pleural effusion, and 7 of these had no demonstrable parenchymatous lung lesions. All the effusions resolved without specific therapy. In 5 or 6 patients the effusion was a prodromal symptom, preceding clinical appearance of arthritis.

Pulmonary parenchymal and pleural rheumatoid nodules occasionally occur with or without effusion. At times one encounters patchy or diffuse fibrosing pneumonitis, and rarely honeycombing of the lung, associated with rheumatoid disease.

Curiously, both in the literature and in the authors' experience, rheumatoid pleural effusions were found to occur more commonly in men despite the predominance of rheumatoid arthritis in females.

Four roentgenograms; 2 photomicrographs; 1 table. G. MELVIN STEVENS, M.D. Palo Alto, Calif.

Pulmonary Infiltrations in Adenovirus Infections. T. Wegmann, G. Kaufmann, and E. Wiesmann. Schweiz. med. Wochenschr. 89: 882-887, Aug. 22, 1959. (In German) (Medizinische Klinik des Kantonsspitals St. Gallen, St. Gallen, Switzerland)

The authors report 9 cases of pulmonary consolidation in adenovirus infection. ["Adenovirus infection" is the term proposed by Enders and his associates (Science 124: 119, 1956) for a virus infection leading to inflammation of the mucosa of the upper respiratory tract and the eyes, with swelling of the submucous lymph follicles and the regional lymph nodes.—Ed.] Six of the patients were soldiers and 3 were civilians. Some required hospitalization and some were treated on an ambulatory basis. The course was febrile or afebrile.

Auscultation of the lungs suggested bronchitis and even pneumonia, but some cases were without any auscultatory findings. Roentgenograms showed motting and peribronchial infiltration or homogeneous

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densities. There was always hilar enlargement. The other clinical symptoms corresponded to adenovirus infection without pulmonary involvement.

The etiology of the pneumonia associated with adenovirus infection is discussed with special reference to localized aspiration pneumonia.

Some interesting serologic findings were observed in this series. Five patients with pulmonary consolidation showed transient positive complement-fixation with ornithosis antigen, whereas in cases of adenovirus infection without pulmonary involvement, the ornithosis reaction was negative. The titer of the complement fixation with ornithosis antigen decreased as the pulmonary findings improved but had no relation to the course of the adenovirus infection. The ornithosis virus could not be found in any of the cases and the clinical picture, including epidemiology, gave no evidence of ornithosis infection. Also in 4 of the 9 patients Wassermann or Kahn tests were positive. All these serologic reactions are regarded as etiologically non-specific or "false" positive reactions.

Three roentgenograms; 4 diagrams; 3 tables.

HERBERT POLLACK, M.D.
Chicago, Ill.

Clinical Diagnosis of Tracheal Adenoma (Cylindroma). Report of a Case. A. Irwin Kleinman and Ida Levine. *J.A.M.A.* 171: 2080-2082, Dec. 12, 1959. (232 Lincoln Pl., Brooklyn 17, N. Y.)

A 48-year-old white woman was admitted to the hospital because of severe respiratory difficulty. She gave a history of intermittent minimal hemoptyses for eighteen years and wheezing respiration, following an attack of bronchopneumonia, for twelve years. Numerous studies in the past, including repeated chest roentgenograms, were reported normal. Bronchoscopy performed on two occasions in 1950 and 1958 was reported as negative for tracheobronchial disease, but did show excessive amounts of thick mucoid secretion. At the time of admission the dyspnea was so severe that the patient was incapacitated. Physical findings suggested obstruction in the trachea. Consequently, tomograms were obtained and a rounded tumor was shown just above the carina. On opening of the trachea, a smoothly covered mass, $1 \times 1 \times 1.8$ cm., was found a little above the carina arising from a narrow stalk. Following its removal, the patient recovered uneventfully and her respiratory difficulty cleared immediately. Tissue studies showed "infiltrative adenoma of the trachea, which histologically is a mucoid epidermoid variant of cylindroma with many atypical cells."

Four roentgenograms do not demonstrate the points under discussion well, although on the tomogram a lesion can be seen in the tracheal air column.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Tracheopathia Chondro-Osteoplastica. Report of a Case. E. J. Green and W. Wilson. *Proc. Coll. Radiologists Australasia* 3: 85-86, December 1959. (Royal Perth Hospital, Perth, Western Australia)

A case of tracheopathia chondro-osteoplastica is described in which a lateral roentgenogram of the neck disclosed numerous discrete oval or irregular patches of calcification in the trachea. This finding is pathognomonic but, since the condition is frequently without symptoms, the diagnosis may be made only incidentally.

One roentgenogram; 1 photomicrograph.

THE HEART AND BLOOD VESSELS

Left Ventricular Angiocardiography in the Diagnosis of Persistent Atrioventricular Canal and Related Anomalies. Eugene Braunwald, Andrew G. Morrow, and Theodore Cooper. *Am. J. Cardiol.* 4: 802-808, December 1959. (National Heart Institute, Bethesda, Md.)

When operation is contemplated in a patient with an intracardiac left-to-right shunt, the exact anatomic lesion or combination of lesions must be clearly defined. In many patients with isolated, uncomplicated atrial or ventricular septal defects careful clinical examination and conventional catheterization techniques are sufficient to supply the requisite information. When the clinical and catheterization findings are atypical or equivocal, however, the presence of a more complex anomaly must be suspected. Among these are combined atrial and ventricular septal defects of the usual varieties, left ventricular-right atrial communication, and the various forms of persistent atrioventricular canal.

At the National Heart Institute, cardiac catheterization is performed preoperatively in all patients with intracardiac shunts. When clinical, electrocardiographic, or radiographic findings suggest the likelihood of a combined lesion, preparation is always made for a detailed assessment of the routes of left ventricular outflow. Indicator dilution curves recorded from a systemic artery following injections into the left heart provide a convenient and accurate means for determining whether or not left ventricular blood is shunted, by any route, into the right heart and pulmonary circulation. While an abnormal curve indicates that left ventricular blood is shunted into the pulmonary circulation it does not identify the specific anatomic defect responsible for the shunt. This information is provided by selective angiography with left ventricular injection. If an interatrial communication is present, the catheter can be passed through it into the left ventricle. If the interatrial septum is intact, the catheter is usually passed across the aortic valve and into the ventricle from the femoral or right radial artery. Urokon 70 per cent has been the only contrast agent employed, and doses of 1 to 1.2 c.c./kg. body weight are usual. The medium is delivered through the catheter by a pressure syringe which permits the injection of 50 c.c. through a No. 8 catheter in less than one second. Biplane films are exposed at the rate of 4 to 6 per second.

The value of left ventricular selective angiography and indicator dilution curves is illustrated by 7 cases—atrial septal defect of the usual type, 1 case; incomplete persistent atrioventricular canal, 2 cases; complete form of persistent atrioventricular canal, 2 cases; ventricular septal defect of the usual type, 1 case; combined atrial and ventricular septal defect, 1 case.

Thirteen roentgenograms.

Clinical and Angiocardiographic Confirmation of the Bernheim Syndrome. M. Herbst, O. Hartleb, and K. Bock. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 91: 679-689, December 1959. (In German) (Karl-Marx-Universität, Leipzig, Germany)

In 1910 Bernheim postulated that an enlarged left ventricle could encroach upon the interventricular septum to such an extent as to cause right heart failure. In the usual case of left ventricular hypertrophy, left

heart failure with pulmonary congestion precedes right heart failure. In the Bernheim syndrome, pulmonary congestion is bypassed and the right heart fails at an early stage of the cardiodynamic disturbance.

Acceptance of the Bernheim syndrome in the past has not been universal. In recent years, however, cardiac catheterization with differential pressure studies and angiocardiography have definitely established it upon a sound basis. The authors report 5 cases in which pressure in the pulmonary artery was lower than in the right ventricle, the latter being crowded by a bulging septum. The cause of left ventricular hypertrophy was supravalvular aortic stenosis in 1 case, aortic valve stenosis in 1, aortic hypoplasia in 1, and coarctation of the aorta in 2 cases.

The Bernheim syndrome is not rare if asymptomatic and borderline cases are included. It has been discovered as early as four years of age.

The authors recognize three stages. In the first, there is crowding of the right ventricle, but the pressure differential between the right ventricle and pulmonary artery is slight and symptoms are absent. The second stage is characterized by insufficiency of the right heart with marked narrowing of the right ventricle but without left heart failure. In the far advanced third stage failure of the left ventricle is also evident.

In the differential diagnosis, congenital heart lesions, especially septal defects with left-to-right shunt, must be excluded.

Ten roentgenograms.

ERNEST KRAFT, M.D.
Northport, N. Y.

Angiocardiography with Hypaque-M, 90 Per Cent. William T. Meszaros, William B. Buckingham, George C. Sutton, and George W. Holmes. *Dis. of Chest* **36**: 642-649, December 1959. (Cook County Hospital, Chicago, Ill.)

The authors obtained good results with Hypaque-M, 90 per cent, for angiocardiographic examinations in 105 patients—38 children and 67 adults. In all the children the angiograms were of excellent quality. With intracardiac (central) injection, the right heart and pulmonary vasculature were well demonstrated also in all the adult subjects. Adequate visualization of the left heart and aorta was obtained with equal frequency regardless of the site of injection, whether central or peripheral, but clearer detail and sharper contrast were observed with successful central injection. In 17 instances, left-sided visualization was unsatisfactory. In 5 cases this was due to cardiovascular disease, such as an obstructed superior vena cava or large left atrium; in 4 it was attributable to technical error, and in 8 the cause was unknown. This low percentage of failure (12 per cent) must be accepted as inherent in the procedure.

There were no serious reactions. A slight sense of heat was noted by 18 patients, and cough occurred in 5. One vomited, 1 had nausea, a third complained of headache, and a fourth went into shock (insulin type of reaction). One child had a single urticarial wheal. The incidence of mild reactions was 26 per cent, and there was no relationship between these and the dosage of Hypaque.

In an Addendum the authors state that 300 additional examinations have been performed with similar results.

Nineteen roentgenograms; 1 table.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Right Aortic Arch Simulating a Mediastinal Tumor. A Case Report. Itaru Ohara. *Dis. of Chest* **36**: 661-664, December 1959. (Tohoku University Faculty of Medicine, Sendai, Japan)

The author describes a case in which a right-sided aortic arch was incorrectly diagnosed as a mediastinal mass. This developmental anomaly is frequently associated with other cardiac anomalies as the Eisenmenger complex and tetralogy of Fallot. It may occur independently.

An x-ray examination should demonstrate the right aortic knob below the right sternoclavicular articulation, with none on the left side. The esophagus (esophagogram) is displaced anteriorly and to the left at the level of the aortic arch. The trachea is similarly displaced. The same changes are produced by mediastinal tumors and, in the presence of dyspnea or dysphagia, cysts of the mediastinum, chondromas, aberrant goiter, lymphoma, aneurysm, exostosis of the sternum, etc., call for differentiation.

Five roentgenograms; 1 diagram.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Chronic Idiopathic Pericardial Effusion Without Tamponade. Daniel C. Connolly, Thomas J. Dry, C. Allen Good, O. Theron Clagett, and Howard B. Burchell. *Circulation* **20**: 1095-1105, December 1959. (Mayo Clinic, Rochester, Minn.)

The 6 cases of chronic pericardial effusion reported here had in common a benign course without tamponade and no demonstrable etiology. In 1 there was an increase in venous pressure but this was probably caused by scarring incident to an old thoracotomy compressing the superior vena cava.

All had rather typical globular enlargement of the cardiac shadow on plain films. In one case pericardial tap was done with air injection. Air-fluid levels were then shown within the pericardium in various positions. Angiocardiography was done in 5 patients, with failure of the medium to reach the edge of the cardiac shadow; the chambers were of fairly normal size.

One patient refused surgery and the effusion regressed spontaneously. In the other 5 surgery was done with removal of the fluid and creation of a window between the pericardial and pleural spaces. On follow-up all remained normal. Extensive laboratory study of the pericardial fluid in the 5 operated cases ruled out lupus erythematosus and any specific inflammatory cause for the effusions.

Thirty-one roentgenograms; 2 electrocardiograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Abdominal Aortography. Colvin H. Agnew and Robert N. Cooley. *Texas State J. Med.* **55**: 945-952, December 1959. (C. H. A., Kansas University Medical Center, Kansas City, Kans.)

This paper is a general discussion of abdominal aortography: its history, technic, indications, hazards and complications, the contrast material employed, and measures to insure safety. The authors consider it a valuable diagnostic procedure, indispensable to the surgical selection of patients with occlusive vascular disease of the abdominal aorta and its branches. With the possible exception of hypersensitivity to iodine, there are no contraindications. The method may not be necessary in the demonstration of abdominal aneu-

al Tumor. 36: 661-662, 1959.

right-sided mediastinal frequently associated with the Eisenmenger syndrome may occur in the right shoulder articulations (esophagus left at a similar level) and may mediate a or dysrhythmia or aberrant sternum.

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Four photographs; 1 table.

Aortic Dissection Due to Translumbar Aortography, with Recovery Following Surgery. Timothy Takaro, E. D. Peasley, M. F. McKeel, and J. L. Wilkerson. *Arch. Surg.* 79: 1023-1027, December 1959. (VA Hospital, Oteen, N. C.)

A 43-year-old white male was admitted to the hospital because of pain in the right foot and leg of nine weeks duration, without claudication. Examination showed

systems but is certainly helpful in establishing the limits, origin, and ramifications of arteriovenous fistulas and congenital malformations of the aorta and its branches.

With the appropriate selection of patients, knowledge of the principles involved, and adherence to the most meticulous technic, aortography can be performed with relatively little risk. Adherence to the following directions will reduce the risks of the procedure: (1) Repeated attempts to puncture the aorta at the same site should never be undertaken. (2) A single film should be obtained after the injection of 5 c.c. of medium; if there is any doubt as to the position of the needle, it should be withdrawn and reinserted at a different level. (3) The volume of contrast material should be limited to 20 c.c. above the renal arteries; if below these there is a complete block of the aorta, delayed filming rather than an increase in amount of agent should be employed to visualize collateral circulation. (4) Serious consideration should be given to limiting the total amount of contrast medium injected during one examination to 60 c.c. (5) Tranquillizers and local anesthesia should replace general anesthesia. (6) Selective visceral arteriography via the femoral artery should not be undertaken in the presence of moderately advanced femoral arteriosclerosis. (7) All patients should be observed in the hospital for twenty-four hours after examination.

Seventeen roentgenograms; 1 photograph; 2 diagrams.

Massive Albuminuria Following Aortography. James A. Kirkland. *Lancet* 2: 1144, Dec. 19, 1959. (Queen's College, University of St. Andrews, Dundee, Scotland)

During the clinical trial of a new paper-strip test designed to detect both proteinuria and glucosuria, a strongly positive result for protein was found in the urine of a patient after aortography with diiodine, the diethanolamine salt of 3,5-diiodo-4-pyridone-N-acetic acid. In an investigation of this occurrence, samples of urine were tested from each of 24 patients before and after injection, in the following groups:

Group A. Aortography (4 patients): Before injection 3 patients gave negative tests; in 1 there was a "trace positive" (+); after injection all 4 were strongly positive (+++).

Group B. Intravenous pyelography (18 patients): Before injection the tests were negative in 12 cases and positive (+) in 6. After injection, the results were recorded as 2 positive (+++); 10 negative (unchanged); 1 positive (increased, +++); 4 positive (unchanged); 1 negative.

Group C. Angiocardiography (2 patients): Tests were negative in both cases before injection; positive (+) in 1 after injection.

These results suggest that the intravascular injection of radiopaque material, particularly into the aorta, may be followed by gross proteinuria. The implication of temporary renal damage is of course obvious, and this is being investigated further.

Four photographs; 1 table.

Aortic Dissection Due to Translumbar Aortography, with Recovery Following Surgery. Timothy Takaro, E. D. Peasley, M. F. McKeel, and J. L. Wilkerson. *Arch. Surg.* 79: 1023-1027, December 1959. (VA Hospital, Oteen, N. C.)

A 43-year-old white male was admitted to the hospital because of pain in the right foot and leg of nine weeks duration, without claudication. Examination showed

palpable right femoral pulsation but no pulses distally. No pulsations were discernible in the left lower extremity. Plain films revealed advanced calcification of the abdominal aorta and both common iliac arteries.

Translumbar aortography was performed, with 70 per cent sodium acetrizoate (Urokon). A 5-c.c. test dose with filming indicated proper placement of the needle so that the definitive 25-c.c. dose was subsequently rapidly injected. Films demonstrated a definite but small aortic mural dissection with the distal end of the pocket just above the aortic bifurcation at L-4. A few hours after the procedure the patient's right flank and leg pain became progressively more severe. In a few days marked weakness of the right lower extremity developed and progressed to almost complete flaccid paralysis. A right femoral arteriogram showed multiple filling defects in the superficial femoral artery.

A clinical diagnosis of dissecting abdominal aortic aneurysm was made and surgery was undertaken. At operation, six days after aortography, there were found intense sclerosis and rigidity of all of the distal aorta, bifurcation, and common iliac arteries. The aorta was opened longitudinally on its anterior aspect and a false lumen was immediately entered, involving over half of the aortic circumference. Definitive therapy consisted of transection of the aorta just distal to the inferior mesenteric artery with joining of the true and false lumina by resection of a portion of the intimal-medial partition between them. The aortic bifurcation was then resected and a Teflon graft anastomosed. The patient made a slow recovery. Three months later he showed only moderate discomfort in the right foot and slight weakness of right lower extremity musculature.

The authors discuss the mechanism of aortic wall dissection produced by aortography. The critical feature is intramural placement of the needle bevel with separation of the aortic layers as the high-pressure contrast material is injected. Arteriosclerotic changes make rapid and extensive dissection possible.

Comment is made on technic aimed at avoiding aortic dissection, and described by others (Bruwer and Ellis: *Surg., Gynec. & Obst.* 107: 287, 1958. Abst. in *Radiology* 73: 135, 1959). Briefly, an initial small injection is made at the level of the 12th thoracic vertebra with assessment of more distal segments. If then indicated, a second tap is made below the renal vessels at L-3 and a larger contrast dose is administered.

Two roentgenograms; 2 photomicrographs; 1 photograph; 1 drawing. JAMES W. BARBER, M.D. Cheyenne, Wyo.

Radiologic Study of Stenosis of the Aortic Isthmus; Contribution of Angiocardiography. A Study of 116 Cases. P. Santy, J. Papillon, P. Marion, J. Bret, F. Pinet, and J. L. Chassard. *J. de radiol.* 40: 735-742, December 1959. (In French) (Centre de chirurgie cardio-vasculaire, Lyons, France)

Observation of 116 patients with coarctation of the aorta, operated on in the Service of Dr. Santy, permitted recapitulation of the classical signs seen on the routine chest film: absence of the aortic knob, rib notching, and cardiac enlargement. The authors insist on less classical signs: the direct visualization of the stenosis and demonstration of the left superior paramediastinal shadow of the dilated subclavian artery.

Angiocardiography shows the type of the stenosis, the origin of the left subclavian artery, the traction

exerted by the ligamentum arteriosum, the shape of the aortic arch, the adequacy of the collateral circulation, and associated lesions. The grouping of these different criteria makes possible recognition of simple, complicated, and abnormal forms.

The authors have used the venous approach for children and thin adults but they believe that retrograde arterial catheterization under controlled hypotension is more precise and is to be preferred.

Sixteen roentgenograms; 10 diagrams.

RENÉ HOURI, M.D.
New York, N. Y.

Clinical Aspects and Pathophysiology of Isolated Congenital Pulmonary Stenosis. A. Tsakiris, F. Schaub, and A. Bühlmann. *Schweiz. med. Wochenschr.* 89: 801-810, Aug. 1, 1959. (In German) (Medizinische Universitätsklinik, Zurich, Switzerland)

The authors discuss the clinical, electrocardiographic, and hemodynamic findings in 18 patients with congenital pulmonary stenosis. The main symptoms of the more severe cases included dyspnea on exertion, precordial pain, and tachycardia, but not cyanosis. Mild degrees of stenosis are usually asymptomatic.

The most prominent physical finding was a loud systolic murmur over the pulmonic valve, often associated with a diminished split second sound. The degree of the split is a reliable index of the severity of the stenosis. Five patients had an atrial sound and 7 a systolic click. The phonocardiogram usually shows characteristic diamond shape, corresponding to the loud systolic murmur.

In all cases there was prominence of the pulmonic cone as a result of the poststenotic dilatation of the pulmonary arteries. Fourteen patients presented radiologic evidence of right ventricular hypertrophy. The right atrium was prominent in 13 cases and in 9 the pulmonary vascular markings were diminished.

The electrocardiogram of the more severe cases revealed the pattern of right ventricular hypertrophy (in 11 instances), in addition to a P-pulmonale and right-sided damage. Atrioventricular block was found only once and a right bundle branch block twice. The right ventricular hypertrophy pattern is of special diagnostic significance, since it practically never occurs with any other noncyanotic congenital heart condition.

During cardiac catheterization, the pressure gradient between the right ventricle and the pulmonary artery was always above 5 mm. Hg. The lowest right ventricular pressure was 35 mm. Hg, the highest 230 mm. The registration of the pressure curve during the process of pulling back the catheter from the pulmonary artery into the right ventricle is of invaluable diagnostic aid in differentiating a valvular from an infundibular stenosis. In this series, 14 patients had a valvular and 3 an infundibular stenosis. In one instance, the site of constriction could not be determined.

Six figures, including 2 roentgenograms; 5 tables.

HERBERT POLLACK, M.D.
Chicago, Ill.

The Pathological Mediastinal Shadow in Anomalous Pulmonary Venous Drainage. H. Warembourg, G. Bonte, M. Pauchant, and J. Caron. *J. de Radiol.* 40: 794-798, December 1959. (In French) (Hôpital A. Calmette, Lille, France)

The authors report a case of anomalous pulmonary venous drainage in a man of forty-nine known to have

had mitral stenosis for the last thirteen years. A routine chest film showed a para-aortic opacity, producing a double contour of the aortic knob and of the descending aorta. Aortography eliminated the possibility that the abnormal appearance was of aortic origin, and angiography revealed a large left superior pulmonary vein terminating in the left innominate trunk.

A study of the gas of the blood confirmed the abnormal pulmonary venous return.

Fifteen roentgenograms; 9 diagrams.

RENÉ HOURI, M.D.
New York, N. Y.

Pulmonary Arteriovenous Aneurysm with a Major Systemic Component. Al. Annamalai, C. Ranganathan, and M. A. Radhakrishnan. *Indian J. Radiol.* 13: 172-186, November 1959. (Government General Hospital, Madras, India)

The literature on pulmonary arteriovenous aneurysm is reviewed and the following classification is presented:

I. Cases in which systemic vessels form a major part of the shunt: These are characterized by a murmur and thrill over the lesion, hemoptysis, minimal polycythemia or a normal red blood cell count, absence of cyanosis and dyspnea, no pulsation of the lesion at fluoroscopy, systemic collaterals demonstrable by contrast radiography.

II. Cases in which pulmonary vessels form a major part of the shunt: Patients in this group show cyanosis, clubbing, polycythemia, dyspnea, giddiness, fainting, telangiectasia of the skin and mucous membranes, and pulsation of the lesion at fluoroscopy. A murmur may or may not be present, and hemoptysis is often delayed.

A thoroughly studied case of pulmonary arteriovenous aneurysm with a major systemic component is presented. This patient also had bronchiectasis in the right upper lobe segment containing the arteriovenous aneurysm. This is believed to be the first published report of such an association.

Eighteen roentgenograms; 1 table.

BYRON G. BROGDON, M.D.
University of Florida

The Problems of Coronary Arteriography. Experiments on Dogs with Mammary-Coronary Anastomoses. W. Porstmann and P. Kokkalis. *Fortschr. a. d. Geb. Röntgenstrahlen* 91: 690-700, December 1959. (In German) (Institut für Röntgendiagnostik der Charité, Berlin-N 4, Germany)

With the progress of cardiac surgery, coronary arteriography for the localization of coronary occlusion has become increasingly important. The contrast material is now injected through a catheter with its tip near the aortic valve. The success of this procedure depends on the degree of pressure of the circulating blood coming from the left ventricle. Thus, in aortic stenosis the jet is greatly diminished, so that the contrast material will not be washed away very rapidly. In most instances, however, induced cardiac arrest with acetylcholine is necessary for a satisfactory result.

As a contrast medium Thorotrast is least irritating but has the disadvantage of inherent radioactivity and carcinogenic properties. Iodine solutions are irritants and are not well tolerated by the myocardium. Only a minimal amount, therefore, can be injected. This can be accomplished by transient cardiac arrest and the blocking Dotter balloon inflated with carbon dioxide.

In dogs acetylcholine-induced asystole is well tolerated for well over twenty seconds, and coronary arteriography has been perfected to such an extent that the finest branches with a diameter of less than 1.0 mm. can be visualized. Successful anastomoses between a main coronary branch and a mammary artery have also been demonstrated. Application of the method in patients presupposes that temporarily induced cardiac arrest with acetylcholine will not be harmful. Actually the entire procedure—heart blocking, injection, and roentgenography—can be completed in ten seconds. A satisfactory contrast material, free from toxic effects on the myocardium, is a prerequisite. So far Renografin has caused the fewest side-effects.

Seven roentgenograms, 1 tracing; 1 electrocardiogram.

ERNEST KRAFT, M.D.
Northport, N. Y.

The Effect of Local Factors on the Portal Venous Pattern. Jerome W. Canter, Isadore Kreel, William S. Rosenthal, and Ivan D. Baronofsky. *Surg., Gyrec. & Obst.* 109: 729-734, December 1959. (Mount Sinai Hospital, New York, N. Y.)

The effects of certain local factors upon the roentgenographic appearance of the portal venous system were investigated. The authors performed percutaneous splenoportography in dogs through the tail of the spleen which had previously been transplanted into a subcutaneous pocket in the anterior abdominal wall. Control splenoportograms were obtained of 16 healthy mongrel dogs. Afterward, a partial constriction of the inferior vena cava was produced in 13 of the animals, immediately above the diaphragm, to induce experimental ascites.

The normal control splenoportograms revealed a clearly defined, moderately tortuous splenic vein, emptying into the extrahepatic portion of the portal vein. The fine intrahepatic portal venous branches tapered gradually to the liver periphery. These branches were discrete and evenly distributed throughout the liver, leaving the parent vessel at an acute angle. A faint opaque blush outlined the limits of the liver. Multiple small portal systemic collaterals were present in the anterior abdominal wall at the site of the splenic fixation.

Following inferior vena cava constriction but before ascites became apparent, no change was noted in the splenic vein, the extrahepatic portal venous branch, or the intrahepatic portal venous branch. The medium-sized and small intrahepatic vessels, however, were narrowed; they did not extend to the periphery of the liver and branched from the main trunk with an increased angulation. If ascites failed to develop, the resulting splenoportograms revealed no change from the control studies. In those subjects where ascites formed, the splenic vein was elongated and narrowed. There was narrowing, also, of the extrahepatic portal venous branches by at least 25 per cent. The major intrahepatic branches were fewer in number and smaller in caliber. The fine branches ended abruptly and did not extend to the periphery. They also left their parent trunks at more obtuse angles.

Following paracentesis in the ascitic animals, the splenic vein and extrahepatic portal vein resumed their normal tortuosity with release from the increased intra-abdominal pressure. Both the extrahepatic and intrahepatic branches increased in caliber. No change was noted in the medium or small intrahepatic vessels.

In two subjects there was a spontaneous loss of ascites after six months. In these, the splenic vein, the extrahepatic portal vein, and large intrahepatic branches returned to normal. The fine vessels revealed no change as compared to the ascitic period.

In the three animals in which inferior vena caval constriction was not performed, artificial ascites was produced by the intra-abdominal infusion of isotonic saline. The splenoportograms of these subjects showed an elongation and narrowing of the splenic vein and extrahepatic portal vein. The large, medium, and small intrahepatic portal branches were moderately narrowed. No differences from the control studies were noted in the pattern of the fine vessels.

Changes in the appearance of the splenic vein and extrahepatic and intrahepatic portal branches, in this investigation, reflected increased intra-abdominal pressure. The changes in the smaller vessels, on the other hand, reflected severe vascular congestion. The alteration of the appearance of the smaller vessels is also seen in human hepatic cirrhosis, although in this latter instance, the changes are produced by nodular hepatic regeneration with distortion of the vessels, rather than simple congestion.

Six roentgenograms. ROBERT E. JACOBS, M.D.
University of Pennsylvania

Extra Hepatic Portal Vein Obstruction. J. W. Laws, R. Leigh, and R. E. Steiner. *Brit. J. Radiol.* 32: 774-790, December 1959. (Hammersmith Hospital and Postgraduate Medical School, London, England)

Extrahepatic portal vein obstruction is discussed from the pathogenetic, clinical, and radiological points of view. Percutaneous portal venography was carried out on over 250 patients. This number included 31 with extrahepatic portal vein obstruction, 15 associated with cirrhosis and 16 secondary to various other causes, as sepsis, sarcoidosis, blood disorders, and trauma.

Clinical Features: In noncirrhotic patients, this condition usually causes hematemesis and occasionally splenomegaly or ascites. Liver function tests are normal. In cirrhotic patients, the complication may not be suspected, although some deteriorate rapidly.

Radiological Features: Esophageal varices were demonstrated in 28 of 30 patients by barium swallow. Films were taken in inspiration, expiration, and during the Valsalva maneuver with the patient erect and recumbent.

Percutaneous transsplenic portal venography established a definitive diagnosis in most cases. After injection of 30 ml. of 85 per cent Hypaque, serial films were taken at the rate of 1.5 per second for twelve seconds. The Valsalva maneuver during exposure should be avoided, inasmuch as it may prevent filling of esophageal and other thoracic collaterals.

Three main patterns are seen in the splenic venogram depending on whether the main obstruction is in the splenic vein near the hilus of the spleen (site "A"), in the main splenic or portal vein (site "B"), or in the porta hepatis (site "C"). Identical appearances occur in patients with and without cirrhosis.

With obstruction at site "A," all the contrast medium is deviated into collateral channels and no information is obtained about the main splenic or portal vein. If a shunting procedure is contemplated, an operative mesenteric venogram is necessary for evaluation of the portal vein, since it also may be obstructed.

With obstruction at site "B," two patterns are possi-

ble. Cavernous transformation of the portal vein may be present, in which case splenorenal anastomosis is the only possible shunting procedure, or one or more large collateral channels, such as the left gastric or inferior mesenteric vein, may be demonstrated. In noncirrhotic patients this picture is definitely indicative of organic obstruction of the splenic or portal vein. If the patient has cirrhosis, mesenteric venography is essential to distinguish between pseudoportal vein obstruction due to a massive shunt and true extrahepatic portal vein obstruction and to determine if there is an adequate portal vein for anastomosis. Portal vein thrombosis may be incomplete and is distinguished from "streamlining" by its marginal position, irregular outline, and constancy on serial films; "streamlining" is usually smooth, central, variable, and near the site of entry of a major tributary.

With obstruction at site "C," there will be distortion or nonfilling of the portal vein or its main branches within the liver. Besides the usual large collateral vessels, numerous smaller veins will usually be seen passing over the surface of the liver. This characteristic picture is usually the result of pylephlebitis and is rare with cirrhosis.

Twenty-one roentgenograms; 1 photomicrograph; 20 diagrams; 1 table. **EUGENE A. CORNELIUS, M.D.**
Houston, Texas

THE LYMPHATIC SYSTEM

Lymphadenography: Its Uses in Haematology. B. Malamos, S. D. Moulopoulos, and A. Sarkas. *Brit. M. J.* **2:** 1360-1361, Dec. 19, 1959. (University of Athens, Athens, Greece)

The authors report their experience in studying the lymph vessels and nodes in 40 patients, 10 of whom served as normal controls while 30 had neoplastic lymphatic disease (lymphogranuloma, acute and chronic leukemia, lymphosarcoma). The technic consisted in first administering a test dose of contrast medium (Urografin), then 0.5 c.c. of patent blue violet in saline subcutaneously in the dorsum of the hand or foot, half an hour to two hours before the radiographic examination. The subdermal lymphatics by this time are visibly blue and can, after cut-down, be injected with Urografin by needle or cannula. The rate of injection was 1 c.c./min. to a total of 4 to 6 c.c. The normal node is well defined, regular in contour, and uniform in density. By contrast, neoplastic nodes are irregular in contour and the medium is irregularly distributed.

Lymphadenography is believed by the authors to be of value in distinguishing between benign and malignant lymphatic diseases. [No benign lymphatic neoplastic diseases were studied in the group, however.] No false positive or false negative studies were reported in distinguishing between normal and neoplastic nodes. There were no complications.

Seven roentgenograms.

G. MELVIN STEVENS, M.D.
Palo Alto, Calif.

THE DIGESTIVE SYSTEM

Lower Esophageal Ring: A Case Report. James W. La Fave, S. Hartley Calin, and Lloyd D. Mac Lean. *Minnesota Med.* **42:** 1601-1607, November 1959. (Ancker Hospital, St. Paul, Minn.)

Ingelfinger and Kramer (Gastroenterology **23:** 419,

1953. Abst. in *Radiology* **62:** 135, 1954) and Schatzki and Gary (Am. J. Roentgenol. **70:** 911, 1953. Abst. in *Radiology* **63:** 601, 1954) first showed that localized areas of constriction of the distal third of the esophagus could produce symptoms of dysphagia. The latter authors believe the clinical and roentgenologic picture in symptomatic patients to be so typical as to represent a distinct clinical entity, which they call "lower esophageal ring." At its distal end the esophagus is seen radiographically to be the site of a symmetrical narrowing, usually 4 to 5.5 cm. above the diaphragm. A sharp right angle is formed by the constricting ring with the esophageal wall. The ring averages 2 to 4 mm. in thickness but fluoroscopically is difficult to demonstrate unless the esophagus above and below is dilated to a greater diameter than that of the constriction. Symptoms are directly related to the diameter—3 to 38 mm.—of the narrowed esophageal lumen. Patients with constrictions of large diameter are usually asymptomatic; those with esophageal rings 13 mm. in diameter or less uniformly have symptoms. Treatment in most cases is education as to proper selection and mastication of food. For patients with small apertures or those few with progressive symptoms, surgical intervention is required.

The authors' patient was a man of sixty years with severe dysphagia. A localized web-like narrowing of the distal esophagus was demonstrated roentgenographically, and operation was undertaken. The web was ruptured by the surgeon's examining finger, and the esophageal lumen at that site was enlarged to near normal size. The gastrotomy was closed, a hiatus hernia repaired, and a Heineke-Mikulicz pyloroplasty performed. Recovery was rapid and uneventful. The patient has remained asymptomatic and capable of eating all foods. At the time of this report, roentgen studies demonstrated only a slight degree of narrowing at the site of the previous web.

Two roentgenograms.

A Benign Tumor of the Esophagus in an Elderly Female; Case Report. Irvin Hyatt and Sheldon C. Kravitz. *Gastroenterology* **37:** 774-778, December 1959. (11 East Chase St., Baltimore 2, Md.)

An unusual neoplasm of the esophagus is reported. The patient was a 79-year-old woman with a three-week history of dysphagia and a weight loss of 15 pounds. The "point of obstruction" appeared to be just below the suprasternal notch.

Examination following a barium swallow disclosed a persistent filling defect in the upper third of the esophagus, measuring nearly 5 cm. in length. Biopsy revealed a benign fibromyxomatous polyp.

A discussion is included of clinicopathologic characteristics of benign esophageal tumors, as well as the differential diagnosis, radiologically, of extramucosal, intramural and intraluminal lesions. An intraluminal tumor usually produces a rounded, centrally located translucent area. The esophageal contour remains smooth without any evidence of irregularity, and the mucosal folds are intact. In an extramucosal-intramural lesion, such as a leiomyoma, the mucosa is usually stretched over the lesion, obliterating the folds and narrowing or compressing the esophagus at this site. In the profile view, the edge of the tumor produces a sharp angle where it meets the uninvoluted wall of the esophagus. Although the esophagus appears markedly narrowed at the site of involvement, there is usually no

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obstruction to the passage of barium. An extramural tumor will usually cast a mediastinal shadow, and in a profile view will produce a rounded, smooth, and sloping indentation in the esophageal wall, rather than a sharp angle.

Surgical considerations are briefly discussed.

Two roentgenograms; 1 photograph.

GORDON L. BARTEK, M.D.
Grand Rapids, Mich.

Significance of the Esophagogastric Angle for the Physiology and Pathophysiology of the Cardia. M. Rossetti. Schweiz. med. Wochenschr. **89:** 1280-1284, Dec. 5, 1959. (In German) (Chirurgische Universitätsklinik, Basel, Switzerland)

The author discusses the importance of the esophagogastric angle (angle of His) in relation to gastroesophageal reflux and hiatus hernia. An acute angle between the esophagus and stomach prevents reflux; it is normally present and is preserved by the integrity of the hiatus of the diaphragm and the cardiofundal ligaments. In such conditions as hiatus hernia and short esophagus, the angle is increased, with a gastroesophageal "funnel" formation. In this event, when the cardia moves in the direction of the upper pole of the stomach, the contractile muscle power can no longer prevent reflux. The valve function exerted by pressure from the fundus of the stomach toward the cardia and the lower segment of the esophagus is no longer present.

Reconstruction of the esophagogastric angle and correction of the function of the cardia are important for the success of operation for hiatus hernia.

Ten roentgenograms; 23 drawings.

JULIUS HEYDEMANN, M.D.
Chicago, Ill.

The Use of Cinefluorography in Upper Gastrointestinal Disturbances. Samuel J. Stabins, Theodore A. Tristam, and James S. Watson, Jr. West. J. Surg. **67:** 303-309, November-December 1959. (The University of Rochester School of Medicine and Dentistry, Rochester, N. Y.)

Cinefluorographic examinations of the esophagus have been performed at the University of Rochester School of Medicine and Dentistry, Rochester, N. Y., in cases of cardiospasm, Plummer-Vinson syndrome, carcinoma, stricture, diverticulum, hiatal hernia, and esophageal varix. Studies have been made of the stomach in carcinoma of the cardia and fundus, ulcers, and pyloric obstruction.

The recording of images at many frames per second has made possible a better understanding of normal and abnormal physiology. Esophageal disturbances overlooked by other methods of examination have been readily seen by this technic. The procedure has also been of value in investigating the mechanism of swallowing and the function of altered relationships after surgery.

Factors for an average patient are 10 ma and 130 kvp. For a two- to three-minute routine study, a skin-dose rate at the table surface, including back-scatter, with the system used by the authors, is less than 1 r per second for the 4.5-inch circle involved.

Six case reports are given: 1 of Plummer-Vinson syndrome; 1 of esophageal perforation with healing brought about by conservative therapy in a patient with adenocarcinoma of the cecum, transverse colon and splenic flexure, with multiple adenomatous polyps

of the ascending and transverse colon; 1 of peptic esophagitis associated with diaphragmatic hernia; 1 of epidermoid carcinoma of the esophagus; 1 of fibrosis and ulceration of the esophageal-duodenal stoma developing two and a half years after surgery for a high gastric lesion; 1 in a patient whose symptoms proved to be due to air swallowing.

Nineteen roentgenograms.

Lymphoma of the G. I. Tract. A. J. Richards. J. Canad. A. Radiologists **10:** 67-72, December 1959. (Regina General Hospital, Regina, Saskatchewan, Canada)

The author reports on 652 cases of lymphomatous involvement of the gastrointestinal tract, either primary or a part of a more generalized process. His findings are comparable to those of other authors, in respect to age and sex, showing a higher incidence of gastrointestinal lymphoma in young adults and a predominance of males.

On the basis of radiological features, cases of gastric lymphoma can be divided into three main groups: (a) those in which there was a polypoid filling defect; (b) those in which there was an infiltrating defect with or without ulceration; (c) those in which there was a generalized accentuation of the mucosal pattern, which was exaggerated but not distorted. Usually there was some preservation of peristaltic activity and pliability. In some patients the disease extended across the pylorus to involve the duodenum or the lymph nodes in close association with the duodenum, an observation rarely made in carcinoma.

In the small intestine, ileus or perforation may have a lymphomatous etiology, and its possibility is even greater if there has been intussusception. The malabsorption type of small bowel disorder reported in patients with this disease was not demonstrated in this study.

Lymphoid tumors of the large bowel present features which are indistinguishable from carcinoma. The tumor is usually polypoid and may be ulcerated. Obstructive features are not prominent in spite of a bulky tumor shown by a barium study.

Eight roentgenograms; 2 graphs.

PETER TORBEY, M. D.
University of Missouri

Radiography of Stomach in Hypertrophic Pyloric Stenosis in Acute Phase and the First Few Months After Surgical or Spasmolytic Treatment. O. Steinicke and M. Roelsgaard. Acta paediat. **48:** 245-254, May 1959. (O. S., Children's Hospital, Fuglebakken, Copenhagen, Denmark)

Meuwissen and Slooff (Am. J. Dis. Child. **48:** 1304, 1934) were the first to point out that hyperperistalsis, dilatation, and retention are not sufficient for a roentgen diagnosis of hypertrophic pyloric stenosis; a 2 to 3 cm. long constantly strictured pyloric canal must also be demonstrated. Olnick and Weens (J. Pediat. **34:** 720, 1949. Abst. in Radiology **54:** 779, 1950) consider the cord-like canal as pathognomonic of pyloric stenosis and call attention to the fact that the narrowed area comprises not only the pylorus itself but also the distal hypertrophic segment of the prepyloric portion. The present authors believe this latter point is very important. Another characteristic roentgen feature is an impression in the duodenal bulb.

Thirty-five infants (29 boys, 6 girls) had a total of 53

x-ray examinations of the stomach. Of 31 who were surgically treated, 14 were examined radiographically only before operation, 9 before and after, and 8 only after surgery. Three of 4 infants treated medically with spasmolytics were examined both before and after treatment, and 1 not until treatment was begun. The x-ray studies were performed after not less than four hours fasting and following the administration of barium sulfate. Attention was focused on the following points: (1) whether the stomach was dilated; (2) whether emptying of the stomach was delayed, *i.e.*, did not start until fifteen-to-twenty minutes after administration of the contrast medium; (3) whether variations could be observed in the lumen of the narrowed prepyloric portion; (4) the length of the narrowed prepyloric portion; (5) the greatest breadth of the narrowed portion. Results were assessed in relation to the time of examination, whether before treatment, shortly afterward (from seven to thirteen days), or later (from three to ten and a half months).

Though dilatation and delayed emptying of the stomach were, as a rule, demonstrated prior to treatment, these phenomena were not invariably present; on the other hand, a narrowed prepyloric portion with no peristalsis was found in all cases. The lumen of the narrowed portion varied slightly. For the most part it was 1 or 2 mm. In 4 infants it was 4 mm., and in these the condition seemed to be less severe. Roentgen studies, performed after pylorotomy, showed the stomach to be normal in size and emptying normally. In addition, a gradually improving filling of the prepyloric portion was demonstrated, so that in most instances the roentgen picture could be considered approximately normal six or seven months after the operation. A similar, though slower improvement, occurred in the 4 infants treated with spasmolytics.

The fact that a rapid improvement of motility of the affected portion reduces the risk of permanent motility disorders favors the surgical treatment of hypertrophic pyloric stenosis.

Six roentgenograms; 2 tables.

Bezoar and Its Potential Imitator. Webster H. Brown and Frank W. Davis, Jr. *Am. J. Roentgenol.* 82: 1041-1047, December 1959. (11 E. Biddle St., Baltimore 2, Md.)

The authors introduce their consideration of the problem of bezoars and their potential imitators with a review of the literature, including the comprehensive work of DeBakey and Ochsner (*Surgery* 4: 934, 1938, 5: 132, 1939) and more recent contributions. Unusual bezoars are distinguished from the group of true bezoars and are classified as (1) atypical bezoars, intragastric masses or pseudoconcretions and (2) "food boli," "food masses," or "food balls." It is in this latter category that the potential imitators are included.

Intragastric food boli may simulate bezoars almost completely except for the production of a hard palpable mass. Ultimately, the diagnosis is confirmed by gastroscopy, although the roentgenologic features are of value in the differential diagnosis. Food masses roentgenologically tend to conform to the contour of the stomach and to fill rather than to expand it; the margins are irregular in contrast to the smooth surfaces of long-standing true bezoars.

Recognition of the potential imitators is of utmost importance in planning therapy. With this diagnosis established, the treatment of choice is nonoperative,

including such measures as massaging the stomach, vigorous lavage, or intragastric instillation of weak hydrochloric acid. Careful observation of the patient is imperative, since dislodgement of the food boli through the pylorus may produce small-intestinal obstruction.

In 2 cases presented by the authors, nonoperative therapy was instituted on the basis of clinical and roentgenologic findings. The first patient, a 43-year-old female with a history of laparotomy for a "food ball" eight months earlier, was admitted because of "stomach trouble" and diabetes.

Abdominal fullness persisted following gastrotomy, and the patient remained malnourished. Contrast studies demonstrated the intragastric foreign material, which remained in the stomach mixed with barium for twenty-four hours. A mass could not be palpated. Following vomiting and removal of undigested food by gastric lavage, interval contrast studies were normal.

The second case, in a 22-year-old psychiatric patient, was investigated because of profound weight loss and abdominal discomfort and distention following compulsive eating episodes. No masses were palpable, although conventional films of the abdomen disclosed semi-solid material and gas in a distended stomach. Following copious vomiting, symptomatic relief and progressive weight gain ensued; no contrast studies were performed in verification of the clinical impression.

Three roentgenograms.

RALPH SCHLAEGER, M.D.
New York, N. Y.

Technical Factors in the Roentgen Examination of the Small Intestine. Ross Golden. *Am. J. Roentgenol.* 82: 965-972, December 1959. (University of California School of Medicine, Los Angeles 24, Calif.)

Roentgen examination of the small intestine, when properly carried out, will disclose abnormalities in a high percentage of cases. This paper stresses the technical factors in order that the examination may be done properly and yield the highest possible percentage of abnormalities. Three basic methods are used:

1. **Barium by Mouth (Small-Intestine Study):** The author uses about 8 ounces of barium-water mixture. After the esophagus, stomach, and duodenum have been examined, an erect film of the abdomen is made following a fifteen-minute interval. A second film is made after another fifteen minutes and, thereafter, films are made at approximately thirty-minute intervals. All films are processed and observed immediately so that the basic routine can be varied as indicated. Transit time is usually between one and three hours. If barium has not entered the cecum by four hours, a stimulus of milk or cold water is given.

An important part of the examination is visualization of the terminal ileum and cecum. Pressure films of these areas are often necessary to disclose the mucosal pattern. Particularly during the process of spot-filming, varying degrees of rotation may be necessary to visualize the cecum free of superimposed and obscuring barium shadows of the more proximal intestine.

Variations of this method using the "divided dose" technic, the rapid method utilizing an ice-cold suspension of barium sulfate followed by ice-cold saline solution, and the large dose technic employing about 16 ounces are mentioned, though not advocated by the author.

2. **Small Intestine Enema:** A tube is passed into the proximal loop of jejunum and barium is injected through

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it under fluoroscopic observation. Spot radiographs, with compression when desired, and routine large films are made as indicated by the findings.

3. Miller-Abbott Tube Study: In the presence of unexplained bleeding or when obstruction is suspected, a Miller-Abbott tube may be introduced. In the latter case, the tube is allowed to progress until the inflated balloon encounters the obstruction. In the presence of bleeding, specimens of the intestinal content are withdrawn at frequent intervals until the site of bleeding is discovered. Barium is then injected through the tube and spot-films are obtained. An advantage of this method is that, when indicated, a balloon can be inflated to block the lumen, thus limiting the distal progress of the barium and forcing the opaque material cephalad.

Commercial preparations of barium sulfate are used which prevent or at least retard flocculation.

The routine use of high-kilovoltage technic is recommended; 120 kv is now employed and it is believed that higher kilovoltages are desirable.

The author concludes "Experience has shown that failure to detect disease of the small intestine is usually the fault of the observer either because he does not carry out the procedure properly or because he does not see an abnormality actually disclosed by the barium shadows."

Twelve roentgenograms.

RICHARD A. ELMER, M.D.
Atlanta, Ga.

Observations on the Small Bowel Pattern Associated with the Zollinger-Ellison Syndrome. John M. Weber, Samuel Lewis, and Kenneth H. Heasley. *Am. J. Roentgenol.* **82:** 973-977, December 1959. (VA Hospital, Pittsburgh 40, Penna.)

The purpose of this report is to describe the small-bowel pattern as observed in 3 cases of the Zollinger-Ellison syndrome—the severe ulcer diathesis associated with non-beta-cell adenomas of the pancreas—and to suggest that this may afford a possible clue to diagnosis.

At first glance the outline of the small bowel seemed smudged and disorganized, but on closer examination a distinctive lacy, cobweb-like pattern was detected in each case. A similar lace-like appearance was present in the only 2 reported cases in which small-bowel roentgenograms were reproduced. In these 5 cases diarrhea was a prominent symptom. If the lacy pattern described should indeed prove to be related to the Zollinger-Ellison syndrome, it is conceivable that it may be found only or predominantly in those patients who have diarrhea as one of the symptoms.

In an effort to learn whether the pattern is peculiar to the Zollinger-Ellison syndrome or is a nonspecific finding, the authors reviewed many cases of sprue, regional enteritis, chronic pancreatitis, lymphoma, carcinoma, and "deficiency patterns." In addition, small-bowel radiographs of many hundreds of patients with duodenal ulcer and small-bowel examinations following subtotal gastric resection were studied. In no instance did the small-bowel pattern found resemble that seen in the Zollinger-Ellison syndrome.

The authors recommend that small-bowel roentgen studies be performed in all patients in whom the diagnosis of the Zollinger-Ellison syndrome is being considered in order to evaluate further the possible relationship of the pattern described to this disease.

Four roentgenograms. RICHARD A. ELMER, M.D.
Atlanta, Ga.

Roentgenologic Evaluation of Mesenteric Small Intestinal Obstruction: A Statistical Analysis. Robert D. Sloan. *Am. J. Roentgenol.* **82:** 978-984, December 1959. (University of Mississippi Medical Center, Jackson, Miss.)

Roentgen examination of the abdomen as a means of evaluating acute intestinal obstruction has been adequately stressed in the past, but there have been few attempts to appraise objectively the relative accuracy of this method of diagnosis. The author reviewed the films of 400 patients for whom recumbent plus erect or lateral decubitus views were obtained.

A five-part classification was set up as follows: (1) no evidence of obstruction; (2) indeterminate evidence of obstruction; (3) obstruction present, mechanical; (4) obstruction present, adynamic; (5) obstruction present, mixed or uncertain type.

Without knowledge of the clinician's reason for ordering the examination or of the final roentgen or clinical diagnosis, the 400 studies were first reviewed and on the basis of the author's roentgenologic evaluation were assigned to one of the above categories. At a later date a second "blind" reading was made by the same physician, without knowledge of the category selected on the first test reading.

The results of these two test readings were compared with the official roentgenographic reports dictated at the time the patients were seen, and finally all readings were compared with the charts and the clinical evaluation of the patients.

Results of this analysis showed that the method is reasonably accurate, and that even in the absence of clinical information a correct appraisal of the situation can be made in most instances. The official report tended in every group to be slightly more accurate than the interpretations under the test situations, indicating that the clinical information available on the requisition slips was of help to the radiologist, although the difference was not as great as was anticipated.

The problem of intraindividual variation is discussed, and the range of errors is found to be comparable to that reported in studies dealing with intrathoracic disease.

Nine tables.

RICHARD A. ELMER, M.D.
Atlanta, Ga.

Mesenteric Cysts in Infancy and Childhood. Review of the Literature and Report of a Case. Ernest E. Arnheim, Herman Schneck, Alex Norman, and David H. Dreizin. *Pediatrics* **24:** 469-476, September 1959. (E.E.A., 133 E. 58th St., New York 22, N.Y.)

Cysts of the mesentery are rare, and in only a few instances has the diagnosis been made prior to surgery. On the basis of 82 cases from the literature and 1 of their own, the authors discuss the pathologic, clinical, and radiologic features, diagnosis, and treatment of mesenteric cysts in infancy and childhood. In their case the roentgen picture, in conjunction with the clinical manifestations, made the diagnosis evident.

The patient, a 16-month-old boy, was admitted to the hospital because of enlargement of the abdomen noted for a period of eight months, and this was the only abnormal finding on physical examination. The circumference was 56 cm., and no masses were palpable. A plain roentgenogram showed a homogeneous density, with absence of air shadows, occupying the left half of the abdomen. No areas of calcification were visible. Most of the intestinal air pattern was in the right upper

quadrant. Barium meal examination revealed pylorospasm and elevation of the antrum by compression of an extrinsic mass. The duodenum was normal. The small intestine was displaced into the right upper quadrant. In the lateral view the loops of small intestine were seen to be displaced posteriorly by a large, lobulated mass, bordered anteriorly by a compressed loop of small intestine. In three hours the barium had progressed to the distal ileum, which was displaced upward by an extrinsic mass in the right lower quadrant. Barium-enema studies and excretory pyelography were normal. It was felt that the shape of the mass and the configuration of the loop of small intestine on its anterior border warranted a diagnosis of mesenteric cyst.

At operation, many multilocular cysts were found occupying a large segment of the mesentery of the lower jejunum and upper ileum. The largest cyst had a dumbbell shape and bulged out on both sides of the mesentery, partly surrounding and compressing the adjacent loop of jejunum. Most of the jejunum and a segment of ileum, measuring about 60 cm. in length, and the mesenteric cysts were excised. At the time of the report the child had been symptom-free for a period of two years; roentgen examination performed fourteen months postoperatively showed normal configuration of the stomach and small intestine and normal progress of the barium.

The authors believe that in the uncomplicated case a complete roentgen examination will provide a diagnosis of mesenteric cyst. Plain roentgenograms of the abdomen reveal a gasless shadow displacing the intestines. Fluoroscopy shows the mass to move with palpation. The normal configuration of the kidneys and ureters on excretory pyelography rules out a retroperitoneal location. A gastrointestinal series establishes the relation of the mass to the intestine, which is usually narrowed over part of its course and displaced anteriorly.

Four roentgenograms; 5 photographs; 1 photomicrograph.

The Treatment of Ileocolic Intussusception. Lee W. Bass, William K. Sieber, and Bertram R. Girdany. *J. Pediat.* 55: 51-56, July 1959. (University of Pittsburgh School of Medicine, Pittsburgh, Penna.)

From 1929 through 1956, 264 children with proved ileocolic intussusception were seen at the Children's Hospital of Pittsburgh. One hundred and sixty-three were treated by surgery alone, with 27 deaths. Six children died before they had received any definitive treatment. In 3 others intussusceptions were agonal and identified at necropsy.

Ninety-two children were treated initially by hydrostatic pressure. In 80, this treatment was successful; in 3 of the 80 roentgen evidence of reduction of the intussusception was not certain but surgical exploration showed it to be complete.

Eleven children had intussusceptions not reduced by hydrostatic pressure. Seven of these were ileo-ileocolic in nature. Three of the failures occurring during early experience with the hydrostatic method were not explained at surgery; these intussusceptions were reduced without difficulty at laparotomy.

Perforation of the colon occurred in 1 three-month-old infant with ileocolic intussusception associated with gangrene. Recovery after surgical resection of the gangrenous bowel was uneventful.

Another three-month-old infant had been given castor oil and was considered too ill for surgery. Hydrostatic

pressure was applied at the request of the surgeon, and reduction was accomplished, but the child died two days later.

In 1 six-month-old infant with ileo-ileocolic intussusception, reduction by hydrostatic pressure was unsuccessful; this was followed by surgical resection of gangrenous bowel. The infant died six hours after surgery. The hydrostatic procedure was carried out while the operating room was being prepared and did not delay surgical treatment.

Filling defects in the terminal ileum during successful hydrostatic reduction of intussusception indicated lead points in 2 children. A polyp and an ileal duplication, respectively, were later resected surgically.

Six children initially treated with hydrostatic pressure had recurrences of their intussusceptions. Two were again treated with hydrostatic pressure and made uneventful recoveries. The other 4 children were operated upon; in 1 a hypertrophied lymph node was thought to be the lead point of intussusception, but in the remaining 3 no lead points were demonstrated.

Reduction of the intussusception by hydrostatic pressure was successful in 25 children with symptoms for more than forty-eight hours. This confirms the impression that long duration of symptoms is not a necessary contraindication to this method of treatment.

The average hospital stay after surgical treatment of intussusception was 12.4 days; after treatment with hydrostatic pressure, it was 3.1 days. Fever was common in children treated surgically, but rare in those in whom hydrostatic pressure reduction was successful.

The method employed in the hydrostatic reduction of uncomplicated ileocolic intussusception is described elsewhere (Girdany *et al.*: *Am. J. Roentgenol.* 82: 455, 1959. *Abst. in Radiology* 75: 497, 1960).

Four tables.

Perforation of the Colon During Examination by the Double Contrast Method. Pal Lörinc and Folke Brahme. *Gastroenterology* 37: 770-773, December 1959. (Malmö Allmänna Sjukhus, Malmö, Sweden)

In a series of 10,000 double-contrast examinations of the colon between 1953 and 1958, there were 2 perforations of the colon without serious results.

In the first case fluoroscopy after the insufflation revealed a benign polyp of the rectosigmoid and air escaping retroperitoneally. The patient had no symptoms and no complications.

In the second case the examination was done for a palpable mass in the right hypochondrium. Immediately following injection of air, the scrotum enlarged to the size of a child's head; the swelling was painless and cleared without complications. Proctoscopy showed the site of the perforation to be the anterior wall of the rectum, just above the sphincter. It was believed to have been caused by the rectal tube. The injury in the first case was thought to be of similar origin.

Four roentgenograms. GORDON L. BARTEK, M.D. Grand Rapids, Mich.

Volvulus of the Proximal Colon. D. deG. Villett. *Ann. Surg.* 150: 1075-1085, December 1959. (University of Natal, Durban, Union of South Africa)

Three cases of volvulus of the right colon are presented along with a review of 150 cases from the literature. The plain film of the abdomen is often diagnostic in that the cecum is dilated and may be twisted out of the right iliac fossa to the left of the midline. The

small bowel is distended and shows fluid levels. A single fluid level is frequently seen in the cecum. Occasionally barium-enema examination is necessary to confirm the diagnosis, since in axial rotation the twisted right colon may lie in the normal right-sided position.

In half of the reported cases there was a history of previous abdominal surgery. Hypermobility of the cecum is a prerequisite, as is a fixed point around which the bowel can rotate. The hepatic flexure or adhesions usually act as the latter.

This condition is a surgical emergency and prompt operative treatment is imperative. In 58 cases in which the bowel was viable, the mortality was 15 per cent. In the absence of viability this figure rises to between 30 and 50 per cent.

Three roentgenograms; 1 photograph; 2 diagrams; 2 graphs; 2 tables. RICHARD H. GREENSPAN, M.D. New Haven, Conn.

"Toxic" Segmental Dilatation of the Colon During the Course of Fulminating Ulcerative Colitis: Roentgen Findings. Bernard S. Wolf and Richard H. Marshak. Am. J. Roentgenol. 82: 985-995, December 1959. (Mount Sinai Hospital, New York 29, N. Y.)

Acute nonspecific ulcerative colitis as an exacerbation of the chronic disease or as the first manifestation of the process is well known. Episodes of fulminating colitis are fortunately uncommon but carry a serious prognosis, particularly when marked dilatation of the colon occurs. The pathogenesis of "toxic segmental dilatation" of the colon is unknown but it is recognized as a dreaded complication of an acute attack. Clinically, the condition is marked by extreme toxicity and high frequency of perforation. The mortality rate is 20 to 30 per cent, and therapy, both medical and surgical, is fraught with difficulty.

In patients with a suitable clinical history, the following roentgen features may be considered to be pathognomonic for "toxic segmental dilatation of the colon" in acute ulcerative colitis: (1) marked distention of one or several parts of the colon; (2) obliteration of the haustral and mucosal pattern; (3) irregular contour of the colon, with multiple deep projections indicative of ulceration; (4) numerous nodular pseudopolypoid intraluminal protrusions; (5) a lack of redundancy or a relative shortening of the colon; (6) inability of the colon to contract normally due to loss of tone.

The segmental distribution of dilated and relatively narrowed segments of colon is not changed by the maneuvers required to obtain prone, erect, or lateral decubitus views. In the erect or lateral decubitus position, fluid levels are few in number and unusually long. The caliber of the distended segment or segments may be greater than 10 cm. A striking roentgen feature is the fact that, despite the marked distention, the location and the length of the visualized portions of the colon are relatively normal. The appearance of very marked distention of one or several segments with intervening relatively narrowed portions is in marked contrast to the findings in mechanical obstruction in which the bowel proximal to the site of obstruction is uniformly and continuously distended as well as redundant. In the segments maximally involved, the normal haustral pattern is completely absent. In less involved portions, the interhastral septa may persist but appear unusually thick and may be incomplete or wavy in contour. The dilated segments tend to maintain a

cylindrical or tubular configuration with rounded, sometimes tapering ends. The bowel has a wavy or scalloped appearance with occasional kinking of one or both contours at an acute angle. Typically, there may be innumerable broad-based nodular pseudopolypoid projections extending into the lumen of the bowel. The thickness of the wall of the colon often seems to be greater than normal, as evidenced by the increased width of the homogeneous gray bands of tissue which intervene between adjacent segments of dilated colon.

Also, in many cases, a large number of air-containing loops of small bowel, which do not appear unusually distended and do not show any systematic pattern, can be seen.

Roentgen differential diagnosis from paralytic ileus or mechanical obstruction, from Hirschsprung's disease, from "sentinel" dilatation with acute pancreatitis, and from markedly dilated loops of bowel in ileo-jejunitis and marked colonic dilatation occasionally seen secondary to sprue, is discussed. None of these conditions, however, show the remarkable localized dilatation in association with evidence of severe intrinsic inflammatory disease of the bowel wall.

In patients with uncomplicated chronic or subacute ulcerative colitis, roentgen examination of the colon may show an abnormal segment of colon indicative of inflammatory disease, but there is no concomitant dilatation. Marked changes may be seen in the appearance of the colon during the course of an acute episode of colitis which may be severe enough to be called fulminating but is not accompanied by dilatation.

Barium enema examination is unnecessary and undesirable, though it is pointed out by the authors that it has been attempted in many instances without apparent complication.

Nineteen roentgenograms.

RICHARD A. ELMER, M.D.
Atlanta, Ga.

The Colon in Systemic Sclerosis (Scleroderma). William T. Meszaros. Am. J. Roentgenol. 82: 1000-1002, December 1959. (Cook County Hospital, Chicago, Ill.)

Roentgen studies of the colon were done in 7 patients with scleroderma and characteristic findings were observed in 3. One of these has been previously reported (Radiology 70: 313, 1958); the other 2 are presented here.

Sacculation is considered by the author to be the outstanding feature of this condition. The saccules are most often located along the inferior surface of the transverse colon and in the descending colon. They are best demonstrated on post-evacuation films. Their differentiation from diverticula of the colon is based on the wide mouths of the saccules. Haustral atrophy in elderly patients may be differentiated by absence of esophageal involvement and partly by the age group.

Colonic involvement may be asymptomatic or may be accompanied by constipation, diarrhea, abdominal pain, bleeding, and distention of the colon on an adynamic basis. Bleeding is predicated on mucosal ulceration secondary to ischemia and the additional factor of trauma due to impacted feces. The author cautions against attributing the atonic colon to mechanical obstruction requiring active intervention, since patients with visceral sclerosis tolerate abdominal surgery poorly.

The 2 cases reported here occurred in females in

the seventh decade, with histologic verification of scleroderma by skin biopsy.

Four roentgenograms. RALPH SCHLAEGER, M.D.
New York, N. Y.

Radiography in the Diagnosis of Hepatic Disease.

John R. Hodgson. *Arch. Int. Med.* **104**: 893-898, December 1959. (Mayo Clinic, Rochester, Minn.)

The author reviews the radiographic procedures now employed in the diagnosis of hepatic disease—simple technics (scout film, pneumoperitoneum); uptake of dense or radioactive substances; and hepatic angiography. He concludes that the radiologist's contribution is fragmentary at best. His helpfulness to the clinician is limited by procedures that are so complex or risky or time-consuming as to be of little practical value. Even with success of some of the complicated and hazardous examinations outlined, only a little information is obtained. It is hoped that the contribution of the radiologist will not always be so meager. The author believes that the possibility of opacifying the liver by use of contrast substances attached to one of its excretory products, such as urea, as suggested by Rigler (*Radiology* **65**: 936, 1955), should be explored. The most needed substance is a radiopaque, stable, colloidal suspension which will be taken up by the liver and will break down in time without toxic effects.

Five roentgenograms.

Roentgenographic Aids in Diagnosis of Neoplasms of Liver and Extrahepatic Ducts. John A. Evans and Zuheir Mujahed. *J.A.M.A.* **171**: 7-11, Sept. 5, 1959. (525 E. 68th St., New York 21, N. Y.)

Of the newer x-ray technics, intravenous and percutaneous transhepatic cholangiography are of little value in visualizing the bile ducts. Intravenous cholangiography is not helpful in the diagnosis of primary neoplasm of the biliary tract, though on occasion it provides useful information regarding secondary invasion of the common bile duct from cancer primary in the biliary tract system. The technic of percutaneous splenoportal venography has been used to opacify the liver with encouraging diagnostic results, although it is not without risk.

The roentgen data from 35 patients with primary carcinoma of the gallbladder are tabulated. Oral cholecystography was performed in 26 patients, with no opacification in 22 (85 per cent). In 4 cases of intravenous cholangiography, opacification was obtained twice: once in choledocholithiasis and once in the presence of a dilated common duct. In the latter case, the gallbladder was not visualized. Plain films of the abdomen showed a mass in the right upper quadrant in 3 of 24 cases. Thirty-two patients had an upper gastrointestinal series and extrinsic pressure on the duodenum was revealed in 10 (30 per cent). Colonic examination was performed on 26 patients and was noncontributory in 25; in 1 a displacement of the hepatic flexure was demonstrated. Of 19 intravenous pyelograms, 18 were noncontributory; 1 showed a displaced right kidney.

On the basis of their observations, the authors conclude that examination of the gallbladder and bile ducts by conventional oral and intravenous cholecystocholangiography is of little value in the diagnosis of neoplasms of the extrahepatic biliary system. In primary carcinoma of the gallbladder, the barium-meal examination has provided useful information in from

one-third to one-half the cases. Operative cholangiography may on occasion demonstrate an unsuspected tumor of the intrahepatic bile ducts, its diagnostic value being in proportion to the care and precision with which the examination is made.

Seven roentgenograms; 1 table.

Oral Cholecystography: A Review of Techniques.

Jerome H. Shapiro, Wilhelm Z. Stern, and Harold G. Jacobson. *Am. J. Roentgenol.* **82**: 1003-1010, December 1959. (Montefiore Hospital, New York 67, N. Y.)

Various technics have been employed effectively to augment basic oral cholecystography. The more important procedures reviewed by the authors include laminography; fluoroscopy with graded compression spot-roentgenography; lateral decubitus positioning, with use of the horizontal beam; tube-tilt roentgenography; and delineation of adjacent hollow viscera by contrast agents. Mention is made, also, of the administration of multiple oral doses of contrast medium on successive days in an effort to opacify nonopaque calculi. It is stressed that no single technic is applicable uniformly to all problems and that each of the many supplementary diagnostic aids may be important in a specific situation.

Twenty-four roentgenograms; 1 table.

RALPH SCHLAEGER, M.D.
New York, N. Y.

The Reinforced Graham-Cole Test. James Ryan. *Australian & New Zealand J. Surg.* **29**: 141-148, November 1959. (Royal Prince Alfred Hospital, Sydney, N. S. W., Australia)

Intravenous cholangiography is used by the author in every case where the oral method shows absence or impairment of gallbladder function, and when stones are seen. Additional information of importance to the surgeon is often obtained regarding obstruction or calculi in the common duct. Anatomical variations in the biliary tract may also be visualized.

Sixty cases are tabulated.

Thirteen roentgenograms; 1 table.

ZAC F. ENDRESS, M.D.
Bloomfield Hills, Mich.

An Evaluation of Operative Cholangiograms as a Guide to Common Duct Exploration. Donald Hight, James R. Lingley, and Frank Hurtubise. *Ann. Surg.* **150**: 1086-1091, December 1959. (27 Elm St., Worcester 8, Mass.)

In a series of 800 patients undergoing surgery for extrahepatic biliary tract disease, operative cholangiography was performed in 591. When the common duct was explored without prior cholangiogram, pathologic changes were found in 58 per cent of cases. Where initial cholangiograms were reported to show stones, obstruction, or tumor, confirmation by exploration was obtained in 82 per cent. The incidence of false negatives in initial cholangiography was 7 per cent and of false positives 5 per cent.

The technic of both injection and radiography is extremely important and poor technical studies will lead to errors in diagnosis. The authors conclude that cholangiography is considerably more reliable than clinical impression as a guide to common bile duct exploration.

Eight tables. RICHARD H. GREENSPAN, M.D.
New Haven, Conn.

Fibroadenoma of Gallbladder. Report of Case with Cholecystographic Visualization. Seymour Fiske Ochsner and G. M. Carrera. *Arch. Path.* **68**: 676-679, December 1959. (Ochsner Clinic, New Orleans, La.)

A case of fibroadenoma of the gallbladder is reported. This is believed to represent a type of neoplasm of the gallbladder hitherto unrecorded. Cholecystograms were taken on five occasions between 1950 and 1957. The earliest one showed a small radiolucent defect, measuring 3 x 5 mm., near the tip of the fundus. In films obtained in 1955, the shadow had enlarged slightly, measuring 6 mm. In roentgenograms taken in 1957, it was unchanged. The radiolucency was fixed in relation to the wall of the gallbladder and was considered preoperatively to represent a polypoid mucosal tumor or possibly an embedded gallstone.

At operation, a small, firm, fixed mass could be felt in the fundus of the gallbladder. The resected gallbladder contained no stones, but there was a mass, 1.6 x 0.8 x 0.8 cm., attached by a filamentous pedicle only 1 mm. wide. The pathologic diagnoses were chronic cholecystitis, Aschoff-Rokitansky sinuses, and fibroadenoma of the gallbladder. The patient has remained well.

Six illustrations, including 3 roentgenograms.

THE MUSCULOSKELETAL SYSTEM

Intraosseous Hemorrhages in Hemophilia. H. Stein and E. Doll. *Fortschr. a. d. Geb. d. Röntgenstrahlen* **91**: 746-750, December 1959. (In German) (Medizinische Universitätsklinik, Freiburg i. Br., Germany)

Hemorrhages into the joints of bleeders are well known and present characteristic roentgenographic findings. Intraosseous hemorrhages, however, are rare and not easily recognized as such.

The authors report a case of hemophilia in a male, aged 43, with a bleeding tendency dating back to early infancy. Six years earlier a fall from a bicycle had resulted in injury to the right hip. Painful swelling developed and the patient had been confined to bed ever since. Four years after the injury there still was marked soft-tissue swelling from the iliac crest downward to the greater femoral trochanter and this had increased.

Needle biopsy revealed a thick membrane at a depth of 3 cm. below the skin surface. Beyond this obstacle fresh and old blood could be aspirated. Motion of the affected hip was painful and restricted. There also was marked limitation of motion of both knees and elbows.

Roentgenograms revealed typical hemophilic joint changes in the elbows and knees. The epiphyseal portions of several long bones showed a honeycomb pattern of radiolucencies which suggested long-standing intraosseous hemorrhages. The right iliac bone was transformed into a large multilocular cystic mass with extreme cortical thinning and interruption of its crest line. The changes extended downward to the ischial bone and backward to the sacroiliac area. The acetabular cavity was grossly enlarged and protruded into the pelvic cavity. The right femoral head rested in the lateral portion of the acetabular roof, which was 6 cm. higher than the left.

Serial roentgenograms taken during the preceding six years disclosed a gradual development of the gross changes. After two more years the large cyst formations and intrapelvic protrusion showed further progression. By this time the femoral head was dislocated

centrally and the iliac crest was completely destroyed. Autopsy confirmed the findings of old and recent hemorrhages with almost complete absorption of bone. Histologic studies revealed processes of osseous transformation with presence of osteoclastic giant cells.

Two similar cases with gross lesions of a pelvic bone have previously been reported, but without autopsy confirmation. Extensive hemophilic changes in tubular bones have been observed more frequently.

In the differential diagnosis one has to consider aneurysmal bone cysts, echinococcal cysts, chondromatosis, myeloma, and osseous fibroma (Jaffe-Lichtenstein). All these conditions can easily be excluded by the history and clinical as well as hematologic findings.

Four roentgenograms. **ERNEST KRAFT, M.D.**
Northport, N. Y.

Skeletal Changes in Wilson's Disease (Hepato-Lenticular Degeneration). Victor M. Rosenoer and R. C. Michell. *Brit. J. Radiol.* **32**: 805-809, December 1959. (St. George's Hospital, London, S. W. 1, England)

Radiological studies of the skeleton were made in 10 cases of Wilson's disease, or hepato-lenticular degeneration. The principal changes were osteochondritis of the spine (7 cases), marginal bone fragmentation (4 cases), osteochondritis dissecans (3 cases), osteoarthritis (5 cases), and osteoporosis (4 cases). Possible mechanisms for these changes are discussed in the light of the known metabolic disturbances. It is clear that osseous involvement may be related in part to a renal tubular anomaly. This in turn may be related to copper deposition in the kidney, which might interfere with the transport mechanisms in the tubular epithelium.

Ten roentgenograms; 1 table.

EUGENE A. CORNELIUS, M.D.
Houston, Texas

Ehlers-Danlos Syndrome with Acro-Osteolysis. T. H. Newton and M. E. Carpenter. *Brit. J. Radiol.* **32**: 739-743, November 1959. (University College Hospital, London, N. W. 1, England)

Ehlers-Danlos syndrome is a hereditary disorder of connective tissue characterized by the triad of (1) increased elasticity of the skin, (2) increased fragility of the skin and blood vessels, and (3) increased joint mobility. Its etiology is unknown.

Minor trauma in patients with this syndrome will cause subcutaneous hematomas. These often heal poorly, with thin scars that break down readily. Subcutaneous nodules may be present, particularly in the legs and forearms. Bone abnormalities such as clubfoot, radiolucluar synostosis, ectopic bone formation about the acetabulum, and dental abnormalities are of frequent occurrence.

The case of a 25-year-old woman with typical changes of the Ehlers-Danlos syndrome is reported. The patient also had acro-osteolysis and marked spondyloolisthesis. The acro-osteolysis involved the central portion of the distal phalanges of the fingers, and is felt to have been due to an abnormality in the perivascular connective tissues leading to interference with the blood supply to bones and peripheral nerves. This was also the cause of the paresthesias affecting the fingers. Resorption of the central portions of the distal phalanges is believed not to have been previously described in this condition.

The case of the patient's mother is also reported.

This was characterized by minimal changes discovered after the diagnosis of the condition in the daughter. The typical subcutaneous nodules permitted a radiologic diagnosis in the absence of symptoms. The subcutaneous calcified nodules are probably pathognomonic for this syndrome. Most are oval and measure 2 to 8 mm. in length. The amorphous center is surrounded by a peripheral ring of denser calcification.

Seven roentgenograms. EDWIN F. KOCH, M.D.
Indiana University Medical Center

Evaluation of Abnormal Stature in the Adolescent and Young Adult. Thomas W. Burns. *Arch. Int. Med.* 104: 930-948, December 1959. (University of Missouri Medical Center, Columbia, Mo.)

Stature is perhaps the simplest physical dimension of man to measure; yet the physiological processes involved in its attainment are among the most complex and poorly understood. This state of affairs can be ignored by the physician until he is confronted with a person who has failed to achieve satisfactory height or who has become excessively tall. It must then be decided whether indeed an abnormality exists and, if so, what is its basis. The author describes the methods of investigation employed, results obtained, and the diagnoses made in 9 patients with abnormally short stature and 2 with excessive height.

As a guide to "normalcy" of the patient's height, use was made of the height charts prepared by Burgess (J. Am. Statist. A 32: 290, 1937). Mental age was estimated by the Stanford-Binet and Wechsler-Bellevue tests. Laboratory procedures to assess the status of the endocrine glands were performed as indicated. To determine bone age, a roentgenogram in the anteroposterior projection of both hands and both wrists was obtained; usually this could be accomplished with a single 8 X 10-in. film. The author believes that for the purpose of clinical evaluation the hand-wrist roentgenogram affords adequate information and seems preferable to the more elaborate roentgen surveys which are costly and time-consuming and expose the patient to considerable radiation. The hand-wrist film gives a good indication of bone age from the appearances of the secondary centers of ossification and time of closure of the several epiphyseal junctions. It also provides information regarding the length and thickness of the tubular bones. Shortening of the fourth metacarpal has been described in association with gonadal dysgenesis and short stature (Archibald *et al.*: J. Clin. Endocrinol. 19: 1312, 1959. Abst. in Radiology 75: 327, 1960). A single lateral view of the skull was obtained of all patients in the present series. This provides information relative to the thickness of the calvarium and malformations of cranial and facial bones, as well as visualizing the sella turcica. While more elaborate techniques may be required completely to define abnormalities of the skull, the single lateral view provides an adequate screening device.

The treatment of dwarfism is generally unsatisfactory. No specific treatment is indicated in hereditary-familial shortness or in delayed adolescence. Replacement therapy with those target-gland hormones that are deficient is called for in pituitary dwarfism. The value of early use of the sex steroids in cases of clear-cut pituitary infantilism has been emphasized by some writers.

Eleven roentgenograms; 22 photographs; 1 chart; 3 tables.

Cervical Diskography: A Contribution to the Etiology and Mechanism of Neck, Shoulder and Arm Pain. Ralph B. Cloward. *Ann. Surg.* 150: 1052-1064, December 1959. (1013 Bishop St., Honolulu 13, Hawaii)

Cervical diskography was performed by the author over the past three years in 114 patients with neck, shoulder, and arm pain. These cases have been analyzed for (1) type and distribution of pain resulting from the injection, and (2) type of disk abnormality demonstrated by the examination.

Pain response is of two types: diskogenic and neurogenic. Diskogenic pain occurs from direct stimulation of the disk and is referred to the ipsilateral scapula or to the midline if stimulation is central. A large series of cases is analyzed for area of pain referral following irritation of disks 3 to 6.

Neurogenic pain occurs from pressure on nerve roots, dural sheath, or the spinal cord. While local pain resembling diskogenic discomfort may be produced, referral to the arms, legs, and distant areas is more common.

Headache, facial and jaw pain, and precordial distress were not produced by disk stimulation, although they have all been attributed to the disk syndrome.

Five roentgenograms; 1 photograph; 6 diagrams. RICHARD H. GREENSPAN, M.D.
New Haven, Conn.

Congenital Sacral Anomalies in Children. E. Durham Smith. *Australian & New Zealand J. Surg.* 29: 165-176, November 1959. (Royal Children's Hospital, Melbourne, Australia)

Twenty-six cases of sacral agenesis of varying degree were reviewed. Frequently agenesis was associated with other anomalies. All of the children showed neurological deficits, with bladder and bowel incontinence, usually severe. No significant improvement occurred with the passage of time. On the basis of the radiological features the cases are classified as agenesis (total and subtotal) and hemisacrum, the latter ranging from lack of development of a half vertebral body and its neural arch to a relatively minor maldevelopment of part of a lateral mass.

Dissection in 6 infants showed that in 4 the nerves corresponding to the absent vertebrae were missing; in the other 2, some of the sacral nerves were present.

Eleven roentgenograms; 2 photographs; 2 drawings; 5 tables. ZAC F. ENDRESS, M.D.
Bloomfield Hills, Mich.

Arthritis of Hip Complicating Osteitis Pubis. Helen Sender. *South African M. J.* 33: 1084-1086, Dec. 19, 1959. (University of the Witwatersrand, Johannesburg, Union of South Africa)

Only rarely has arthritis of the hip been known to occur in association with osteitis pubis. A case is reported in which drainage, in October 1958, of a large pelvic abscess of undetermined origin in a 50-year-old man, was followed by osteitis pubis in December and in March 1959 by limitation and pain on movement of the left hip. Narrowing of the hip joint was demonstrated radiologically in February 1959, followed by progressive erosive changes of the articular surface of the femoral head and acetabulum. By June 5 the picture was definitely one of septic arthritis, with discharge.

The spread of infection can best be explained by

transfer through soft and bony venous pathways between the anterior inferior pelvis and hip. The condition appears to be a purulent arthritis, directly related to a low-grade osteomyelitis of the pubis and ischium, and resistant to cortisone and antibiotic therapy.

Five roentgenograms.

THE SPINAL CORD

Angiomas of the Spinal Cord. G. Lombardi and F. Migliavacca. *Brit. J. Radiol.* **32**: 810-814, December 1959. (Neurological Institute, Milan, Italy)

Eighteen cases of angioma of the spinal cord are reported under four headings: incidence, clinical diagnosis, radiological diagnosis, and treatment. The incidence was higher than is usually supposed. A comparison with the spinal tumors operated on (200 cases) in the same period gave a ratio of 1:11.

The age range was eleven to sixty-seven years. The average duration of symptoms was 5.7 years. The lower dorsal and lumbar regions were the sites in 14 cases; in 4 cases the cervical region was involved. Motor disturbance (usually spastic) in the limbs was the most common symptom. Paresthesias and pain were also frequent. Subarachnoid hemorrhage occurred in only 2 cases. Thus the clinical picture was nonspecific.

The only osseous change appears to have been erosion of a pedicle, observed in one case. Myelography with iodized oil is necessary for diagnosis. Large quantities (5 to 6 ml.) facilitate the visualization of the vascular pattern. In the simpler more frequent forms, one or more transparent streaks, tortuous or interrupted, are observed. Deposition of contrast medium around vascular loops may give rise to filling defects of the lacunar type, with polycyclic outlines. The lesion is always more extensive than demonstrated by myelography since only superficial vessels can be delineated.

The diagnosis of angioma was made in 15 of the authors' 18 patients by means of myelography. The diagnosis was obscured in one case by arachnoiditis and in another by a contiguous neurinoma. In the third case, close grouping of the vessels suggested an endodermal tumor. When the vascular outlines can be seen, the only other diagnostic possibility is compensatory arterial circulation in the cervical region in coarctation of the aorta (Wyburn-Mason).

Thirteen cases were explored. In only one could the malformation be removed, and this patient died four months later.

Twelve roentgenograms; 1 table.

EUGENE A. CORNELIUS, M.D.
Houston, Texas

Intradural Arachnoid Cyst of the Lumbar Spinal Canal. R. O. Murray. *Brit. J. Radiol.* **32**: 689-692, October 1959. (Royal National Orthopaedic Hospital, London, England)

The literature concerning congenital spinal cysts has accumulated slowly since the report of Elsberg *et al.* (Bull. Neurol. Inst., N. Y. **3**: 395, 1934) until, with the example reported here, there are 36 recorded cases. The great majority of these cysts have been located in the thoracic spinal canal, but a few have occurred in the lumbar region; most but not all are extradural. The extradural cyst may be explained on the basis of herniation of the arachnoid through a congenital defect or into a congenital diverticulum of the dura mater. The

intradural cyst, on the other hand, may form as a result of diverticula of the arachnoid itself without penetration of the dura.

The case recorded here is of interest both for its location in the lumbar canal and for its intradural location. The bone erosion of the neural canal which occurred was thus presumably of the aneurysmal type, pressure being transmitted through the enclosing dura mater. Whereas the radiological findings on the plain film were such as might be the result of any space-occupying lesion, the appearance on the myelogram was unusual, with pooling of the opaque medium in each of the erosive depressions formed in the posterior aspects of the affected vertebral bodies. This appearance is believed to have been reported only once previously (Cloward: Ann. Surg. **105**: 401, 1937).

Because the clinical picture in these lesions may be comparable to that of lumbar or lumbosacral disk protrusion, the importance of myelography for the diagnosis is stressed.

Six roentgenograms. L. RAY STEWART, M.D.
Indiana University Medical Center

GYNECOLOGY AND OBSTETRICS

A Robert Pelvis: A Case Report and Review of the Literature. Irwin H. Kaiser. *Am. J. Obst. & Gynec.* **78**: 1208-1211, December 1959. (University of Minnesota Medical School, Minneapolis, Minn.)

Heinrich Ludwig Ferdinand Robert in 1842 first described the severely and symmetrically transversely contracted female pelvis which bears his name. In the true Robert pelvis, which is undoubtedly of congenital origin, the transverse diameter of the inlet is contracted in proportion to the diameters of the midplane and outlet; there is no history of infection or trauma. In pseudo-Robert pelvis the inlet is relatively large in its transverse measurements compared with the midpelvis and there is a history of severe injury or infection of the pelvic bones.

Ten cases of true Robert pelvis, proved at autopsy or radiologically, and 6 of pseudo-Robert pelvis have appeared in the literature. To the former group the author adds 1, the first instance to be reported in the Western Hemisphere. The severe contraction of the pelvis, demonstrated by x-ray, necessitated delivery by cesarean section.

Two roentgenograms; 1 photograph.

ROBERT L. EGAN, M.D.
University of Texas, Houston

THE GENITOURINARY SYSTEM

The Pelvi-Ureteric Junction: A Cine-Pyelography Study. Howard G. Hanley. *Brit. J. Urol.* **31**: 377-384, December 1959. (Institute of Urology, London, England)

This report is based upon some 500 pyelographic studies carried out with the x-ray image intensifier for all conceivable types of renal pathology. A majority of the patients had no disease referable to the pelvi-ureteric junction *per se*. From these studies it would appear that most individuals have a funnel-type renal pelvis with a wide open junction; a few (approximately 10 per cent) have a rounded pelvis with a physiologically "closed" type of junction. These two types merge imperceptibly into each other. Both are consistent with perfect renal function, but the closed or tonic type of

junction may cause transitory pelvic dilatation during diuresis.

The "empty" type of pelvis usually has a funnel-shaped pelvi-ureteric junction, and while there may be good radiological contrast in the calyces, the pelvis and certainly the pelvi-ureteric junction may not be clearly defined during an excretion pyelogram. Any sudden diuresis has little effect upon the size of such a pelvis, since the distention reflex merely increases the rate of the emptying contractions passing through the pelvi-ureteric junction. If one gently overfills such a pelvis and then quickly withdraws the catheter, the medium will pour out of the pelvis in a continuous stream and, although emptying contractions can be clearly seen, at no time is the column of medium interrupted until the excess fluid has been evacuated. At this stage the normal pattern of emptying wave from pelvis to upper ureter re-establishes itself, at first at a rapid rate and then much more slowly. One gains the impression that this funnel-neck junction is open, or nearly so, at all times.

The "filled" pelvis with the "closed" type of junction shows quite a different emptying pattern. There is always a "hold-up" at the junction before the pelvic wave passes on into the upper ureter, and this degree of hold-up varies with the amount of distention of the pelvis (and therefore with the degree of diuresis) but appears to be a constant feature for any given patient. This type of pelvis is very sensitive to a sudden diuresis, which will produce quite an appreciable increase in the pelvis size. Over-distention produces exactly the opposite effect from that shown by the funnel-type junction. The pelvis becomes more rounded, and when the catheter is withdrawn no opaque medium escapes, while all calyceal, pelvic, and ureteric movement may be completely inhibited for several seconds. Even when contractions of the pelvis are resumed, there may be further delay before any medium can be seen passing through the junction. When, finally, emptying does start, each contraction terminates with a sort of "gulp" as the junction is drawn upward.

Clinically, these observations can be demonstrated during excretion pyelography by giving copious volumes of fluid to drink immediately after the exposure of the five-minute film. In the patient with a funnel-type junction there will be no alteration in pelvic size, while the radiological contrast may be markedly reduced. In patients with "tonic" or "closed" type junctions such a procedure will frequently result in an enlargement of the pelvis, and an increase in the radiological density.

A review of the roentgenograms and operative findings in a personal series of some 170 patients undergoing conservative plastic surgery for hydronephrosis would seem to indicate that hydronephrosis is more likely to develop in patients with rounded pelvis and tonic junctions. Awkwardly situated vessels or bands are much more likely to press upon the ureter when the pelvis is rounded and varies in size with diuresis than when there is a simple funnel-type pelvis which is relatively empty at all times. Since the predisposing factor in hydronephrosis appears to be some defect in the pelvi-ureteric junction which may still be present after the freeing of all adhesions and vessels, the best results will follow the removal or refashioning of the opening so as to convert it from a "tonically closed" to a "wide open funnel" junction whenever this is possible. The actual technic employed to accomplish this is of relatively

little importance. The author believes that the great majority of hydronephrotic kidneys are well worth saving, particularly since the condition is potentially bilateral.

Seven roentgenograms; 3 drawings.

Cystography with Controlled Filling Pressure in Children. Eric Rostgaard Christensen. *Acta radiol. 52:* 426-432, December 1959. (Rigshospitalet, Copenhagen, Denmark)

Surgical treatment of urinary disease in children necessitates some special studies both for diagnosis and evaluation of postoperative results. The author uses cystography with control of the filling pressure by an infusion apparatus, as described by Dean, Lattimer, and McCoy (*J. Urol.* **78:** 662, 1957. *Abst. in Radiology* **71:** 463, 1958). All forms of reflux may be demonstrated and evaluation of the result of various reflux operations is possible.

A small Foley catheter (8 to 14) is inserted into the bladder and connected to a flask containing Hypaque (12 per cent). The flask is fixed on a stand so that it stands 60 cm. above the symphysis. The drip is started at a rate of 250 drops per minute corresponding to about 50 ml. of fluid. The following films are obtained:

1. *Anteroposterior.* In the event of unilateral reflux or no reflux at all, thirty minutes must pass before a delayed reflux can be demonstrated.

2. *Right and left obliques.*

3. *Micturition films* in the oblique plane, with the patient standing if possible. If the child cannot void, the bladder is emptied through the catheter in order to find out whether the residual urine remains in the pelvis or ureter ("trapping").

4. *Anteroposterior following micturition.* If contrast medium still remains in a pelvis, ureter, or in the bladder, older children are instructed to void three times in all, a film being obtained after each act ("triple voiding"). In the case of infants, a film is exposed immediately after the next spontaneous micturition.

Because of high gonadal doses delivered in this examination, the author recommends shielding of the scrotum in boys and doing the examination in girls only for strict clinical indications.

Eighteen cystographic examinations were done in 16 children between the ages of one and twelve years. There were 15 cases of recurrent pyuria and 1 case of incontinence. Eight girls and 2 boys were found to have reflux, combined in 4 cases (1 male) with sclerosis of the sphincter.

Reflux is not infrequent in recurrent urinary tract diseases. The etiology can be determined only by micturition cystograms, either by demonstration of a rigid, internal sphincter or of a voiding reflux into a frequently ectopic double ureter. It is of utmost therapeutic importance to ascertain whether the reflux is due to infra-vesical obstruction or to primary insufficiency of the ureteral orifice.

If the contrast medium is not trapped in the ureter but flows freely from it, a reflux operation is not always necessary, but expectant treatment may be instituted by the "triple voiding" method. The various forms of reflux found in 10 cystographic studies with controlled filling pressure were as follows: 7 bilateral, 3 unilateral, 7 free reflux, 3 "trapping," 3 delayed reflux, 2 voiding reflux, and 2 emptying by triple voiding. Several forms of reflux may be present in the same subject. Reflux in apparently normal subjects may occur, due to an

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anomaly in which the ureter has a somewhat wide orifice and follows a short intramural course through the bladder.

It is important not to use contrast media which are local irritants as these, in themselves, may cause reflux. Dilatation of the bladder must not be performed, as this may produce a flare-up of any existing urinary tract infection. The use of a filling pressure of 60 cm. water, just above the detrusor muscle pressure of the bladder, insures that the drip almost ceases when the bladder has been filled.

Six roentgenograms; 1 photograph.

JOHN P. FOTOPoulos, M.D.

Northwestern University Medical School

Presacral Retroperitoneal Pneumography Utilizing Carbon Dioxide: Further Experiences and Improved Technique. Ralph R. Landes and Charles L. Ransom. *J. Urol.* **82**: 670-673, December 1959. (776 Main St., Danville, Va.)

A nationwide survey of the hazards of retroperitoneal pneumography revealed 122 cases of severe gas embolism, 58 of which ended fatally. It also demonstrated: (1) that the presacral route was less hazardous than the flank route for the injection of the gases but was by no means safe; (2) that oxygen was little, if any, safer than air as far as gas embolism was concerned, while helium was probably the most dangerous; (3) that the safety of gases was proportional to their solubilities and that carbon dioxide (which is twenty times as soluble as oxygen and 60 times as soluble as helium) is therefore the safest; (4) that no precautions in technic could preclude with certainty the occurrence of a gas embolism when air, oxygen, or helium was used.

The authors use carbon dioxide and cite clinical and experimental observations indicating its safety. For its introduction they have devised a technic which utilizes two vinyl catheters inserted through needles into the presacral space, one on either side of the midline. The catheters are connected to the limbs of an ordinary T-tube which is connected to a 3-way stopcock to which also is connected a 50-c.c. syringe and the tubing from the tank of carbon dioxide. The rate of flow of the carbon dioxide is controlled by a needle valve as the syringe is alternately filled and emptied. Incidentally the authors warn that the carbon dioxide tank should be marked "100 per cent carbon dioxide" in order that it may not be confused with the mixture of carbon dioxide and oxygen used for anesthesia.

Fifty cubic centimeters of carbon dioxide is injected alternately on each side until 750 c.c. to 1,500 c.c. has been introduced, and the films are then made. Satisfactory results are obtained in 50 per cent of the cases on the first attempt. In 25 per cent of the cases one side is well visualized but not the other. The poorly visualized side is then reinjected with the same amount of the gas or more (1,000 to 1,500 c.c.). It is pointed out that, although the first injection is painful, repeat injection is not. If there is an inadequate amount of gas bilaterally, more must be injected bilaterally and in amounts equal to or greater than that originally employed.

Prone as well as supine films are recommended. Excretory urography, retrograde pyelography, and tomography may also be combined with the study.

Three roentgenograms; 3 photographs.

F. J. MUNSON, M.D.

University of Pennsylvania

Some Problems Arising During Micturating Cysto-Urethrography. Lockhart Fraim-Bell, John Grieve, and Cecil Pickard. *Brit. J. Urol.* **31**: 440-446, December 1959. (L. F.-B., St. Thomas's Hospital, London, England)

Micturating cysto-urethrography has been performed by the authors in 63 patients at Dundee Royal Infirmary and in 49 at St. Thomas's Hospital, London. The group was made up largely of out-patients, male and female, young and old. Various contrast media were employed—diiodine, 12 or 15 per cent; sodium iodide, 12 1/2 per cent; Umbroil; Hypaque, 45 per cent. The Umbroil was used to outline the urethra and in some cases was injected before the sodium iodide or diiodine, in others after. In the few patients in whom it was tried, 30 ml. of 45 per cent Hypaque given intravenously concentrated sufficiently in the bladder for satisfactory pictures. Either a Tieman or a Jacques catheter was passed and, after the bladder was emptied, 250 ml. of diiodine or sodium iodide was injected by a Thomson-Walker syringe. A fine cuffed endotracheal tube was passed into the navicular fossa or the bulbous urethra and the cuff inflated with air or water. Contrast medium was introduced by syringes or by gravity. The use of a manometer during filling and voiding was found to supply valuable data on possible reasons for sphincter inefficiency.

Among the conclusions reached by the authors are the following: Micturating cysto-urethrography proved valuable for demonstrating bladder diverticula. In the patient of average build who voided to order, excellent cine films of both filling and emptying were obtained with the image intensifier. Lateral views have not been satisfactory. If a patient cannot void readily, x-ray dosage even with the image intensifier builds up rapidly. No technic has been devised which will give consistent pictures of the urethra under varying conditions and interpretation of such films must be guarded. Micturition against resistance has been of help.

The work of Caine and Edwards (*Brit. J. Urol.* **30**: 34, 1958. *Abst. in Radiology* **73**: 660, 1959) established the idea of active and passive continence, and this was linked to an internal sphincter with involuntary control and an external sphincter with voluntary control. Clegg (*J. Anat.*, London **91**: 345, 1957) provides evidence of a compound sphincter with an involuntary and voluntary component. It is only when a pathological change occurs that there appear to be two separate sphincters; under normal conditions there is complete synergism. The present authors' findings support Caine and Edwards' concept of active and passive continence but suggest that these terms should apply to the pathological rather than to the physiological state.

Nineteen roentgenograms; 1 photograph; 1 diagram.

MISCELLANEOUS

The Radiological Demonstration of *Dracunculus medinensis*. George Cohen. *South African M. J.* **33**: 1094-1095, Dec. 26, 1959. (Johannesburg, Union of South Africa)

Dracunculus medinensis (Guinea worm) was demonstrated roentgenologically in soft tissues of the forearm, wrist, and hand of a middle-aged African male at the Lambaréne Hospital of Dr. Albert Schweitzer, appearing as multiple linear, oval, and serpiginous opacities from 1 to 40 mm. in length and 0.1 to 1.0 mm.

in width. From their size and shape some of these obviously represented dead male parasites which, so far as the author knows, had never been shown before by x-ray. This finding disproves the belief that the male parasite is confined to the groin (Manson-Bahr:

Tropical Diseases. London, Cassell, 13th ed., 1950).

The author believes this to be the first reported case of Guinea-worm infestation from the west coast of Africa south of the equator.

One roentgenogram, with accompanying diagram.

RADIOTHERAPY

Techniques and Early Results of Treatment of Carcinoma of the Larynx and Pharynx by Supervoltage Radiation. Constance A. P. Wood. *Brit. J. Radiol.* 32: 661-668, October 1959. (Hammersmith Hospital, London, W. 12, England)

The author reports her experience in the treatment of carcinoma of the larynx and pharynx with an 8 MV linear accelerator. The increased depth dose at this high voltage makes possible a vastly improved dose distribution. The maximum dose of 8 MV x-rays falls 2 cm. below the skin.

Cases of carcinoma of the larynx and carcinoma of the pharynx with no node involvement are treated through a single lateral port of 4×4 or 5×5 cm., or slightly larger, to deliver 6,200 r or 5,700 rads in thirty treatments over six weeks. In cases of carcinoma of the pharynx with node involvement, the author utilizes two tangential opposing ports. Post-cricoid carcinoma is treated through two anterior oblique 10×5 cm. fields with use of a wedge filter and increased dosage in the lower aspects of diverging ports.

A good initial response of the primary growth and nodes was obtained in over 80 per cent of the cases of laryngeal cancer. Two-year survivals in Copenhagen Stages I, II, and III were 73 per cent of 30 cases, 64 per cent of 20 cases, and 65 per cent of 19 cases, respectively. There were no survivals among the 3 cases of Stage IV treated.

A good initial response was also seen in pharyngeal cancer involving the vallecula and epiglottis, though only 50 per cent of the post-cricoid growths disappeared or became smaller. The former group had a 52 per cent two-year survival and the latter group only fifteen per cent.

Twelve figures; 7 tables.

CHARLES H. HELMEN, M.D.
Indiana University Medical Center

Eighteen Cases of Cancer of the Oesophagus Treated with Tele-Cobalt-Therapy. G. Pisani and A. Malaspina. *Panminerva med.* 1: 201-205, September 1959. (Via Giulietti 11, Novara, Italy)

Between July 1957 and September 1958, the authors treated 18 patients with cancer of the esophagus with a 1,050-curie Co⁶⁰ unit. The unit was equipped for pendulum and rotation irradiation with a 55 cm. radius. The series comprised 15 men and 3 women from forty-eight to seventy-five years of age. All suffered from some degree of dysphagia. Roentgen examination in all showed a neoplastic stenosis of the esophagus, but in none was complete obstruction present. In 14 cases the diagnosis was based solely on clinical and roentgen findings; in the other 4, it was confirmed by esophagoscopy. In no instance were visceral metastases clinically or roentgenographically demonstrable. Metastasis to the lymph nodes in the left supraclavicular region had occurred in 2 cases, to the right jugular-carotid nodes in 1, and to mediastinal nodes in 3. The neoplasm was localized in the upper third of the esophagus

in 3 cases, in the medial third in 9, and in the lower third in 4. In 2 patients the abdominal part of the esophagus, cardia, and the cephalic extremity of the stomach were involved.

Irradiation was administered either by the rotation technic or by convergent beams. High doses (6,000-6,500 r) were given in four or five weeks, in daily doses of 150-200 r. As 4,000 to 4,500 r frequently induce esophageal disturbances (retrosternal pain and burning on deglutition), doses were often strictly fractionated; sometimes, in the presence of severe esophageal distress, treatment was divided into two cycles, with a forty-five- to sixty-day interval, for a total dose of about 7,000 r. Two patients received, in two cycles, 8,600 and 9,000 r, respectively. In advanced cases, with greater extension of the neoplasm and poor general condition, palliative treatment was performed, intended to improve canalization of the esophagus. In these cases daily doses of 100-150 r were delivered in a period of forty to fifty days, for a total of 4,000-5,000 r.

Six of the 18 patients died before the sixth month, 2 after seven months, and 2 after eight months. Eight patients were still alive at the time of the report, i.e., between three and twelve months after treatment. Three patients had recovered clinically twelve, eleven, and nine months, respectively, after irradiation. Surviving patients showed a marked improvement before the end of treatment, with disappearance of roentgen evidence of stenosis and reduction of both neoplastic masses and infiltration. In 7 cases the tumor was no longer demonstrable roentgenographically, and the esophageal plicae returned to normal. No untoward general effects from the irradiation were encountered, even in patients whose general condition was poor. Only in those in whom the epigastric region was also exposed were any bad effects observed.

The authors believe that it is undeniable that telecobalt therapy provides good palliation, even in patients in poor condition or with massive tumors who could not benefit from roentgen therapy.

Ten roentgenograms; 5 isodose curves; 1 table.

Primary Lymphosarcoma of the Stomach. Charles C. Wolferth, Jr., Luther W. Brady, Horatio T. Entline, and William S. Blakemore. *Surg., Gynec. & Obst.* 109: 755-761, December 1959. (University of Pennsylvania, School of Medicine, Philadelphia)

The authors report on 26 cases of primary gastric lymphosarcoma treated in the Hospital of the University of Pennsylvania from 1939 to 1957 inclusive. Among 15 patients there were 7 five-year survivals, which is considered to be far superior to the results for carcinoma of the stomach.

Of the 26 patients, 17 were females and 9 were males; the age of onset ranged between thirty-six and eighty-eight years with an average of sixty-one years. The symptoms were variable, but epigastric pain, loss of weight, and vomiting were most commonly present. In 10 patients, a palpable abdominal mass was found.

Severe anemia was encountered but no abnormal white cell counts were seen. Roentgen examination was the most useful diagnostic aid and in 18 of the patients was interpreted as showing a malignant tumor. At laparotomy, the majority of the tumors were diagnosed as lymphomas by their clinical appearance and on frozen section. If the lesion was judged by the surgeon to be inoperable, only a biopsy or a palliative type of operation was performed. Twenty-one of the tumors were reticulum-cell sarcomas.

In 15 cases, a curative type of gastric resection was carried out. Fourteen patients received postoperative x-irradiation with an average dosage of 1,464 rads to the midplane of the stomach in a median time of thirty-three elapsed days.

In the group in which operation alone was performed and the pathological specimen showed positive nodes, the median survival period was eighteen months. In a similar group receiving postoperative irradiation, the median survival time was increased to thirty months. If the surgical specimen showed no node involvement and no further therapy was carried out, the median survival time was thirty-nine months, as compared to thirty-six months with postoperative therapy.

The most interesting finding is the correlation of the survival period with curative resection. When a curative surgical procedure alone was performed, the median survival was thirty-nine months. When a similar group received postoperative therapy, the median survival was sixty-six months.

Four tables.

MIGUEL CHIAPPORI, M.D.
University of Pennsylvania

Nephroblastoma (Wilms' Tumor). Prognosis More Favorable in Infants Under One Year of Age. John K. Lattimer, Meyer M. Melicow, and Aurelio C. Uson. *J.A.M.A.* 211: 2163-2168, Dec. 19, 1959. (Babies Hospital, New York, N. Y.)

This is a report on 42 children with Wilms' tumor examined and treated between 1934 and 1956, with all cases followed for three years or more. All patients were under the age of nine years and most under five years. Various combinations of radiotherapy and surgery were utilized, but most patients were treated by nephrectomy and postoperative roentgen therapy, which combination the authors feel to be the most efficacious.

General features of history, physical examination, and radiographic findings are reviewed, and the pathologic findings are described. Two clinical points of interest include the demonstration of hypertension in 60 per cent of the patients whose blood pressures were recorded and the occurrence of gross or microscopic hematuria in a surprisingly large number (25 per cent). Unfavorable features in prognosis include rupture of the renal capsule, invasion of the renal vein, a high erythrocyte sedimentation rate, origin in the upper renal poles, distant metastases, and age at discovery (over two or three years). Analysis of therapeutic results, however, indicates that some patients with a group of adverse factors did unexpectedly well, so that the goal of treatment in every case should be a cure.

The prime differential diagnostic problem is sympathoblastoma. The fact that this latter tumor arises outside the kidney can usually be recognized on suitable pyelographic studies. It is likely to show calcification within its substance (30 per cent of cases) and has a considerable tendency to metastasize to bone, both features

unusual in nephroblastoma. Benign hydronephrosis is the most common cause of a renal mass in very young children and may mimic malignant tumor rather closely. This is one of the strong arguments against preoperative radiotherapy for suspected malignant conditions of the kidney.

Analysis of therapeutic results indicates that of the 42 children 45 per cent have survived three years or more. Children in whom tumors were discovered and treated before the age of two years showed a 70 per cent cure rate. Of the 20 patients who died postoperatively (no surgical deaths), 17 succumbed to metastases in less than two years. Consequently, the authors conclude that survival of over two years indicates a good chance of cure.

In the 26 cases treated by nephrectomy and postoperative radiotherapy, survival was achieved in 11. Of 5 very young children treated only by nephrectomy, 4 have survived.

Two roentgenograms: 2 photographs; 1 graph; 2 tables.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Techniques for the Intracavitary Treatment of Bladder Neoplasms with Radioactive Solutions Contained in a Rubber Balloon. G. M. Dyche and N. R. Mackay. *Brit. J. Radiol.* 32: 752-756, November 1959.

The Intracavitary Treatment of the Bladder with Radioactive Colloidal Gold. G. M. Dyche and N. R. Mackay. *Brit. J. Radiol.* 32: 757-763, November 1959. (Institute of Cancer Research, Royal Cancer Hospital, London, S. W. 3, England)

In their first paper the authors describe a technic for the intracavitary irradiation of the bladder with a radioactive fluid contained in a rubber balloon. The procedure is applicable to small superficial, diffuse mucosal tumors, multifocal in origin and thus necessitating treatment of the entire bladder mucosa. This type of tumor represents approximately 10 per cent of all bladder neoplasms seen in the authors' clinic.

Early technics using radioactive fluids in the bladder called for very short treatment times and extremely high dose rates—in the range of 1,000 rads per hour. At this rate, irreversible changes occurred in the bladder wall, necessitating total cystectomy in a number of cases. In an attempt to lower the incidence of radiation-induced bladder damage, the current technic was devised. A solution of calcium bromide 82 is placed in a rubber balloon previously introduced into the bladder. A surface gamma dose of 4,200 rads and a beta dose of 1,000 rads is delivered in ninety-six hours. With this technic, the dose rate at the end of treatment was 30 rads per hour as compared to the earlier dose rates of 1,000 rads per hour. With the low dose rate there was a complete absence of immediate or delayed bladder reactions. Of 20 patients treated, however, only 4 remained tumor-free after three years.

Since the use of non-colloidal radioactive solutions in a balloon is not an ideal means of irradiating the whole bladder mucosa, the authors devised a method for using intravesical Au¹⁹⁸ without a balloon to treat the same type of multifocal neoplasm. A system for the introduction of this isotope into the bladder is described in their second paper. Radioactive gold was felt to be advantageous in that 90 per cent of the surface dose is due to beta radiation, so that the mucosa may be given a high dose without damage by gamma rays to the

underlying muscle and submucosal vascular plexus. Their hopes were not fully realized, however. Forty-one patients were treated, and in 4 severe complications developed.

Clinical results in the 41 cases showed that the bladder was completely free of tumor two to three months post-treatment in 20 per cent, and these patients had remained tumor-free for one to two and a half years. More commonly the great majority of the tumors in a given case were cleared, but a few neoplasms persisted which had to be treated by transurethral diathermy.

While avoiding some of the disadvantages of radioactive fluid in a rubber balloon, the use of colloidal Au¹⁹⁸ suffers from the disadvantage of the rapid fall-off in depth dose. The authors conclude that an isotope with a more energetic beta emission, available in a stable colloidal form, would appear to be more suitable.

The two articles include 5 tables, 2 diagrams, and 5 graphs.

RICHARD L. JONTZ, M.D.

Indiana University Medical Center

Carcinoma of the Penis—Radium Treatment—Assessment of Results. K. M. Rai. Indian J. Radiol. 13: 155-171, November 1959. (Madras Medical College and Government General Hospital, Madras-3, India)

Carcinoma of the penis in Europe and in the United States is said to account for approximately 2 to 5 per cent of all carcinomas in the male, whereas in Asia the incidence rises to 20 per cent. The relationship of penile cancer to the status of the prepuce and circumcision is discussed. In a group of 565 penile cancers, none were found among Muslims (who practice circumcision).

One hundred one cases of carcinoma of the penis were treated with a cylindrical radium mold of light wood soaked in collodion, delivering 6,000 r to the skin and 4,800 to 4,900 r to the mid-shaft in seven days. Many cases were lost to follow-up and consequently only 47 cases treated since 1949 are analyzed. Survival rates are given for each year during the past ten years. These range from 93.6 per cent survival at the end of the first year to 50 per cent survival at the end of the ninth and tenth years. Each yearly group of patients is quite small, numbering from 1 to 10 per year. In view of the size of the series and the inadequate follow-up, the figures should be accepted with some reservation.

The mid-shaft penile dosage has recently been increased to 5,500 r in seven days. The results of this increase will be assessed later.

Nineteen figures: 5 tables.

KEITH EARDLEY, M.D.
University of Florida

Diagnosis and Treatment of Tumors of the Testis. John F. Patton, Clarence B. Hewitt, and Nicholas Mallis. J.A.M.A. 171: 2194-2198, Dec. 19, 1959. (Walter Reed Army Hospital, Washington, D. C.)

A largely statistical report is based on a study of 510 cases of tumor of the testis treated at Walter Reed Army Hospital. Only 1 per cent of all malignant tumors occur in the testis, but this lesion is nevertheless one of the most common malignant growths encountered in the twenty to thirty-fifth year age group. In this series, 37 per cent were seminoma, 31 per cent embryonal carcinoma, 25 per cent teratocarcinoma, 2 per cent choriocarcinoma, and 2 per cent miscellaneous.

The tumor developed in a cryptorchid testis in 5 per cent of the cases. The point is made that successful

orchiopexy does not lessen the chance of malignant disease, which is estimated as five to fifty times greater in a cryptorchid than in a normal testis. In 1 per cent of patients in this series a tumor occurred also in the opposite testis. The authors' impression is that in persons who have had a testicular tumor the probability of development of a tumor on the opposite side is increased forty- to fifty-fold.

Metastasis from testicular tumors is commonly by way of the lymphatics, with the exception of choriocarcinoma, which spreads by the hematogenous route. Note is made of the occurrence of "skip metastasis," in which one or more groups of lymph nodes are by-passed by the metastatic tumor emboli. Approximately one-fourth of the patients had grossly evident metastases when first seen, and the overall mortality in this group was 92 per cent. In 40 per cent of the patients metastatic disease was eventually found. Symptoms and history are of little value in diagnosis. General features of physical examination, radiologic findings, and laboratory studies are reviewed.

Results of therapy are presented in tabular form. Three hundred eighty-nine of the initial 510 cases are suitable for analysis of therapeutic results.

FIVE-YEAR SURVIVAL IN SERIES OF 389 PATIENTS

Type Tumor	Total	Dead		Alive or	
		From Tu- mor	From Cause	Other	Dead Without Tumor
Seminoma	138	11	24	127(92.0%)	
Embryonal carcinoma	125	70	7	55(44.0%)	
Teratocarcinoma	103	57	4	46(44.7%)	
Teratoma	8	1	0	7(87.5%)	
Choriocarcinoma	8	7	0	1(12.5%)	
Other	7	4	0	3(57.1%)	
Total	389	150	35	239(61.4%)	

At the Walter Reed Hospital tumors of the testis are managed as surgical emergencies. There seems general agreement that a high orchietomy performed through an inguinal incision should be the first approach. After permanent pathological sections have been made and the patient studied for possible metastases, further treatment is decided upon.

For seminoma the authors recommend irradiation to the abdominal lymphatic chain with delivery of a 2,000-r tumor dose through opposing portals over an average treatment period of twenty-eight days.

For embryonal carcinoma or teratocarcinoma, a bilateral lymphadenectomy is performed through a transperitoneal approach if no metastases are evident clinically. If removed nodes are positive for tumor, or if the case is found inoperable, then postoperative irradiation is applied to the entire lymphatic chain with an attempt to deliver 4,000 r depth dose to each area over a treatment period of about one hundred and ten days. An upper abdominal port is usually treated first. Million-volt therapy is desirable, if not essential. In cases with clinical evidence of metastasis before treatment, simple orchietomy is followed by irradiation only. The authors note that of 127 patients so treated [tumor types not stated] none were cured. Occasionally nitrogen mustard, ACTH, or other chemical agents may produce mild palliation.

Adult teratoma is treated as for teratocarcinoma.

For choriocarcinoma, simple orchiectomy is performed. Metastases cannot be effectively managed by either lymphadenectomy or irradiation. Chemotherapy may offer some hope.

Five small tables present the statistical data.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Acute Leukemia Treated by Irradiation and Marrow Transplant. A Case Report Emphasizing Metabolic Imbalance. Alice Gamble Beard, Howard J. Barnard, S. William Ross, and F. Dixon Conlin. *J. Pediat.* 55: 42-50, July 1959. (University of Arkansas Medical Center, Little Rock, Ark.)

The authors record their experience with a four-year-old boy with acute stem-cell leukemia who, after all conventional methods of treatment had failed, was given lethal total-body irradiation followed by intravenous administration of donor marrow. The radiologic, hematologic, and metabolic complications in this case are discussed.

The authors first saw the patient during the fourth month of his illness. On treatment with Amethopterin, 2.5 mg. daily, there was a partial remission lasting four weeks. Two months later there was a complete remission, coincident with the administration of 80 units of ACTH gel daily for ten days. The patient was then maintained on 37.5 mg. of 6-mercaptopurine for two and a half months; he was clinically well and hematologically free of abnormal cells. Following this remission, the marrow and peripheral blood again showed many blast cells and few platelets. No hematologic response was obtained from ACTH or from prednisone and Amethopterin, and marked anemia, petechiae, bone pain, and swelling of the joints continued. At this time irradiation and marrow transplantation were decided upon. Aureomycin was given prophylactically for three days, after which cobalt-60 gamma irradiation was administered, with an effective whole-body dose of 700 r.

After irradiation, the patient appeared sallow and the cardiac rate rose, as did the respiratory rate, which was

accompanied by an expiratory grunt. Hydrocortisone sodium succinate, intravenously, was begun but tachycardia, tachypnea, and hypertension continued. Arrhythmias noted four hours after irradiation disappeared with fluid therapy. Thirty-six hours after irradiation the patient was given 5.8 billion donor marrow cells in 125 c.c. of the donor's plasma intravenously. There was no reaction. On the third postirradiation day marked oliguria was present. Cystoscopy was performed, and the right ureter and kidney pelvis were irrigated with bicarbonate solution. The left ureteral orifice could not be visualized. Despite intravenous sodium bicarbonate, the patient became more acidotic and oliguric. There was no evidence of marrow regeneration, and death ensued on the fifth postirradiation day.

The treatment of this patient had two major phases: first, irradiation to destroy the acute leukemia cells and depress the antigen-antibody response to the point where the body would not react unfavorably to the bone-marrow components administered as the second phase of therapy. The problem of hyperuricemia with metabolic imbalance and renal failure had not been adequately anticipated as a complication of the lethal whole-body irradiation and bone-marrow transplant. In management of acute leukemia with antimetabolites and steroids, this problem is minimized by alkalinizing the urine with sodium bicarbonate. This alkalinization should also be done prior to, and through, the period of cellular breakdown following irradiation. Since the demands upon the renal system are great, any evidence of renal impairment might militate against whole-body irradiation. By fractionating the dose of irradiation before transplanting bone marrow, it may be possible to "plateau" rather than peak the metabolic solutes necessarily cleared by the kidneys. Exchange transfusion might also be considered.

In view of the multiplicity of facets to the problem of lethal irradiation and marrow transplant, the authors feel that a successful outcome of this procedure is "most improbable at the present time."

Two tables.

RADIOISOTOPES

Radioiodine in the Evaluation of the Thyroid Nodule. Robert E. Mack and Leroy F. Ortmeier. *Surg., Gynec. & Obst.* 109: 668-672, December 1959. (VA Hospital, St. Louis, Mo.)

The authors describe their experience with a newer type counting system in which the variations in radioiodine concentration, as perceived by the scintillation counter, were recorded by means of a conventional counting rate meter on a strip-chart recorder. The stable electronic circuit in a single channel pulse-height analyzer was used to discriminate against all radiation not directly emanating from the source; moreover, a "focusing-type" lead shield was employed to increase the counting efficiency. The output of the scaling circuit of the scanner was connected to a counting rate meter and its graphic recorder. In this way, variations in radioiodine concentration were recorded, not only on the scintigram, but also as a parabolic curve on the counting rate record. From these data three-dimensional models of isotope distribution were constructed.

The studies were made with plastic thyroid models into which various types of defects were introduced

before filling with solutions of radioiodine of appropriate concentration prior to scanning. The counter system was adjusted in each individual determination, so that the greatest possible contrast between background radiation and radiation in the thyroid model could be obtained. The three-dimensional models of the radioiodine distribution were constructed from each scintigram by transferring the counting rate meter record to cardboard, trimming the outline, and mounting in slotted wooden blocks.

In a number of experiments performed, it was determined that the three-dimensional models depicted radioiodine-poor defects that were as little as 0.7 cm. in diameter. Defects of such a small size could not be appreciated on the corresponding scintigram.

The authors expect to continue to employ the scintigram for interpretation because of their long familiarity with its use; however, they feel that the three-dimensional models are much more accurate in detecting abnormalities of radioiodine distribution.

Six figures.

HORACE SCOTT, M.D.
University of Pennsylvania

Thyrotoxicosis Treated with Small Repeated Doses of Radioiodine. Elmer L. DeGowin, Robert E. Hodges, Henry E. Hamilton, and Titus C. Evans, with the assistance of other members of the Thyroid Clinic. *Arch. Int. Med.* 104: 959-965, December 1959. (University Hospitals, Iowa City, Iowa)

A series of 338 patients with thyrotoxicosis were treated with average administered doses of 4.6 mc I^{131} and observed at three-month intervals for at least six months after the euthyroid state had been attained or until permanent myxedema from therapy had been demonstrated. Of the 338 patients, 199 (58 per cent) had goiters classified as diffuse; 62 (18 per cent) had nodular goiters, and 53 (15 per cent) had goiters recurring after thyroidectomy; in 24 patients (7 per cent) the examiners disagreed on the type of gland or could palpate no thyroid tissue.

Sixty-seven per cent of the doses of I^{131} administered ranged between 3.0 and 6.0 mc; 90 per cent were in the range from 1.0 to 8.0 mc; all doses were within the limits of 1.0 to 15.2 mc. Control of the thyrotoxicosis was achieved in 60 per cent of the patients with a single dose of I^{131} and in 86 per cent with one or two doses. The overall incidence of permanent myxedema was 9.1 per cent. Thyroid storm developed in 1 patient during treatment. No instance of radiation thyroiditis was observed.

The results in this series compare favorably with those of other series treated with higher average doses of radioiodine.

Seven tables.

Total Body Radiation and Dose to the Ovaries from a Therapeutic Dose of Iodine 131 . H. E. Duggan, D. B. Scott, and Dorothy L. Weijer. *J. Canad. A. Radiologists* 10: 56-59, December 1959. (University Hospital, University of Alberta, Edmonton, Alberta, Canada)

This paper deals with the radiation dosage resulting from the administration of a 9-mc dose of I^{131} for hyperthyroidism to a 47-year-old woman, 5 feet 1 inch tall and weighing 73.5 pounds. The total-body irradiation dose (exclusive of the dose to the thyroid) was estimated to be 15 rads and dosage to the ovaries was thought to be 9 rads.

In determining total-body irradiation some simplifying assumptions were made as follows: (a) Excretion of the I^{131} is entirely through the kidneys. (b) The I^{131} not yet excreted or decayed and not contained in the thyroid is uniformly distributed throughout the body. (c) The body is homogeneous and of density unity. (d) The beta radiation from I^{131} content is entirely absorbed within the body. In measuring radiation to the ovaries the following sources of radiation were considered: (a) beta radiation from blood flowing through the ovaries; (b) gamma radiation from the thyroid; (c) gamma radiation from extrathyroidal tissue; (d) gamma radiation from the bladder; (e) gamma radiation from the colon.

Significant somatic damage is unlikely to result from total-body irradiation of the amount recorded in this instance but the dose to the ovaries may have genetic significance, and it is suggested that the therapeutic use of I^{131} should proceed with due regard for the latter hazard.

The methods employed in the analysis of this single case are being applied to a series of similar cases.

Two graphs.

Autoradiographic Localization of Thyroid Hormones in the Organs and Tissues of the Rat. Renato Baserga. *Arch. Path.* 68: 621-629, December 1959. (Northwestern University Medical School, Chicago 11, Ill.)

An attempt was made to investigate the peripheral distribution of endogenous thyroid hormones by autoradiography in the rat. To increase the yield and accuracy of positive autoradiographs, two other procedures were employed: the administration of thyroid-stimulating hormone (TSH), which accelerates the release of hormones from the thyroid gland, with a peak after two to three hours, and the stripping-film technique, which gives a more detailed autoradiographic localization.

The results of the present experiment, while confirming previous biochemical findings on the distribution and fate of thyroid hormones in the body, indicate that by the use of proper methods the peripheral distribution of endogenous thyroid hormone or its metabolites may be determined by autoradiography and the cellular localization ascertained. The number of positive autoradiographs was found to be increased by the administration of TSH a few hours before death. It is conceivable that preparation of the animals with a low-iodine diet and treatment with thiouracil may increase further the amount of labeled thyroid hormones present in the tissues.

Ten figures; 1 table.

I^{131} -Rose Bengal Test of Liver Function. A Clinical Evaluation. Antonio M. Garcia, Kamaluddin Ahmad, Audrey V. Wegst, and William H. Beierwaltes. *Gastroenterology* 37: 725-734, December 1959. (University Hospital, Ann Arbor, Mich.)

The authors present clinical results of the I^{131} -rose bengal test for liver function in 86 adult patients. The Nordyke and Blahd method (*J. Lab. & Clin. Med.* 51: 565, 1958) was used with some modification. Two scintillation detectors were employed, one over the head, with external collimation, the other over the abdomen without collimation. A lead brick was placed on the abdomen between the liver edge and the detector tube. The meters were adjusted to a 2 per cent error. Forty-minute head counts were done in place of the usual twenty-minute counts.

Twenty-six patients with various disorders not associated with liver disease served as controls. In these the bromsulphalein retention was under 6 per cent at forty-five minutes. Forty-three nonjaundiced patients with liver disease were studied, with a bromsulphalein retention of 6 per cent or greater. Thirteen cases of intrahepatic and 4 of extrahepatic obstructive jaundice were also investigated.

In patients without significant liver disease the head counts (clearance of I^{131} -rose bengal from the blood) ranged from 51 to 88 per cent with a mean of 70 per cent \pm 10.5. The upper limit of normal was 81 per cent. The head counts of nonjaundiced patients with liver disease ranged from 48 to 93 per cent with a mean of 71.71 per cent \pm 11.9. Patients with jaundice due to intrahepatic obstruction gave counts of 59 to 97 with a mean of 85 per cent \pm 10.5. In these patients the abdominal count (appearance of the radioactive dye in the small bowel from biliary excretion), twenty-five minutes after administration of homogenized milk to enhance bile flow and cause gallbladder contraction, ranged from 2 to 68 per cent with a mean of 18.5 \pm 16.7. The head counts of the patients with obstructive jaundice of

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The authors felt that differentiation between non-jaundiced patients with or without liver disease could not be made by means of head and abdominal counts. In their hands the I^{131} -rose bengal test was not as sensitive as the conventional bromsulphalein excretion test. The combined use of head and abdominal counts, however, permitted good differentiation of intrahepatic from extrahepatic obstructive jaundice. Head counts alone failed to achieve this result.

Four combinations of curves are reproduced for a differential diagnosis in various mixtures of intrahepatic and extrahepatic obstruction.

One photograph; 6 graphs; 4 tables.

GORDON L. BARTEK, M.D.
Grand Rapids, Mich.

Hepatoscintigrams After the Injection of Denatured Human Serum Albumin Marked with I^{131} . B. Dela-loye, P. Magnenat, and S. Cruchaud. Schweiz. med. Wochenschr. 89: 1305-1308, Dec. 12, 1959. (In French) (Clinique médicale universitaire, Lausanne, Switzerland)

The authors have utilized the property of Kupffer cells to phagocytose denatured human serum albumin labeled with I^{131} to obtain hepatoscintigrams in various normal and pathological cases. By this technic it is possible to obtain a precise diagnosis of some hepatic conditions: cysts, primary and metastatic tumors, and abscesses of more than 2 cm. diameter.

The authors have confirmed their observations at autopsy, laparoscopy, and laparotomy. They conclude that the method is as satisfactory as that using I^{131} rose bengal. Practical advantages are better contrast, less radioactivity, and low cost.

Eight hepatoscintigrams; 1 photograph.

RENÉ HOURI, M.D.
New York, N. Y.

Alterations in Iodine-131 Distribution in the Rat After Whole-Body X-Irradiation. D. D. Ulmer, L. B. Perkins, and J. G. Kereciales. Radiation Res. 11: 810-819, December 1959. (D.D.U., Peter Bent Brigham Hospital, Boston 15, Mass.)

Although the animal and human metabolism of fallout isotopes has been extensively explored, the influence of external ionizing radiation on the uptake, distribution, and excretion of such elements has received comparatively little attention. Storer and Simonson (Proc. Soc. Exper. Biol. & Med. 90: 369, 1955) reported studies indicating that exposure to whole-body x-irradiation alters the level of plasma iodine 131 in the rat and that such a response may have usefulness as a biologic indicator. The present report is concerned with additional changes in the distribution of radioiodine subsequent to irradiation.

Rats weighing 238 to 325 gm. were exposed to 900 r of whole-body x-irradiation. Immediately thereafter they were injected intraperitoneally with 1 ml. of aqueous solution containing 20 μ c of carrier-free I^{131} as the sodium salt. Twenty-four hours after irradiation the animals were killed and the uptake of I^{131} by the major organs was determined.

Marked alterations were found in the distribution of I^{131} twenty-four hours after irradiation; distribution in the control animals was in general agreement with that recorded by other authors. There was a reduction of

20 per cent in urinary and fecal loss of radioiodine. Radioactivity was increased in the blood, most of the organs, and particularly in the contents of the stomach and in the pelt, as compared to that in nonirradiated controls. The possible mechanisms of these variations are discussed. There was no significant difference in the uptake by the thyroid in the two groups of rats.

Two figures; 1 table.

Extent of Nonspecific Background Localization of Radioiodinated Serum Proteins in Human Tumor and Normal Tissues. Eugene D. Day and Ahsen Özarda. J. Nat. Cancer Inst. 23: 1477-1482, December 1959. (Roswell Park Memorial Institute, Buffalo, N. Y.)

Knowledge of the background localization of radio-labeled control proteins is necessary to demonstrate the specific localization *in vivo* of radiolabeled antibody in human tumors. The twenty-four-hour uptake of intravenously injected, radioiodinated, rabbit- and human-serum globulins and human-serum albumin, in a variety of human tumors (15 in all) and normal tissues, was measured after surgical excision. Regardless of size, location, or type of tumor, or type of radiolabeled serum protein for assay, the uptake per gram after one day was about 0.004 per cent of the injected dose per gram in a 50-kg. patient, or 0.003 per cent in a 75-kg. patient. The average uptake per gram of normal tissue was not statistically different. The ratio between the doses in normal and tumor tissue for each patient averaged 0.92 ± 0.36 per cent for 14 of the patients. Considering that the tissues were not perfused, were weighed as wet samples, and extended over a variety of vascular types, and that the patients ranged in age from forty-seven to eighty-three years and in weight from 46 to 72 kg., such values appear to be surprisingly uniform. Moreover, there was as much uniformity among the 15 tumors as there was within a single one.

Even with the rather high background encountered in this study, a tumor-localizing antibody-globulin preparation would easily be recognized if it assayed over 0.01 per cent per gram. For example, a whole globulin that might contain 1 per cent localizing antibody (some whole antikidney antiserum globulins assay as high as 3 per cent), if distributed evenly, would be recognized as containing antibody even in as large a tumor as 100 gm. It can be expected, therefore, that except for antiserum globulins of extremely low titer and tumors of extremely large size, localizing antibodies in general should be detectable in human tumors when the whole radioiodinated globulin containing them is injected twenty-four hours before surgical removal of the tumor.

Two tables.

Results of the Radioisotope Renogram and Comparison with Other Kidney Tests Among Hypertensive Persons. Chester C. Winter, Morton H. Maxwell, Robert E. Rockney, and Charles R. Kleeman, with the technical assistance of Cecelia R. Schmitt and Noland Johnson. J. Urol. 82: 674-680, December 1959. (University of California Medical Center, Los Angeles, Calif.)

The radioactive renogram affords information as to renal vascularity, tubular-cell function, and ability to evacuate urine. Used as a qualitative test to detect unilateral renal dysfunction in hypertensive subjects, it compares favorably with conventional renal function tests but as yet lacks the instrumentation and accuracy

necessary for evaluating quantitatively individual kidney function. Its chief value lies in cross-comparison of the two kidneys.

The kidneys are first localized by a conventional roentgenogram. An intravenous injection of a minute quantity of radioactive (Hypaque-I³¹) is made and a tracing, called a renogram, is obtained with external radiation detectors and recorders. The procedure has been described elsewhere (Winter: *J. Urol.* **78**: 107, 1957. *Abst. in Radiology* **70**: 902, 1958). This study causes no untoward reaction, usually lasts ten to thirty minutes, is of a reasonable cost, and can be done in the office. However, even with this test there is no reliable method of predicting which patient undergoing renal parenchymal or arterial surgery will be cured of his hypertension. Consequently, the authors feel that all hypertensives with unilateral renal disease or renal arterial disease should be considered possible candidates for surgery.

A group of 56 patients with unilateral abnormal renograms also underwent individual kidney evaluation by a variety of conventional individual renal tests which included determination of urine volumes, PSP excretion, PAH clearances, aortography, etc. Comparison showed the results of these tests and the radioisotope renogram to be in agreement in 85 per cent of the group.

Seven figures.

CARL KAPLAN, M.D.
University of Pennsylvania

The Relative Biological Effectiveness of Co⁶⁰ Gamma Rays and Fission Neutrons: Lethal Effects on the 4-Day Chick Embryo. Howard H. Vogel, Jr., and Donn L. Jordan. *Radiation Res.* **11**: 667-683, November 1959. (Argonne National Laboratory, Lemont, Ill.)

The comparative effects of fission neutrons and Co⁶⁰ γ -rays were studied, with the four-day-old chick embryo as the test object.

Fertile White Leghorn eggs were incubated for four days, and the embryos were irradiated *in ovo* with single exposures to fission neutrons or Co⁶⁰ γ -rays. At two intervals, six hours and six days, after irradiation, the eggs were opened and the embryos scored for survival, depending on presence or absence of the heart beat.

A dose of 540 ± 9 rads of fission neutrons or $1,191 \pm 31$ rads of γ -rays from Co⁶⁰ killed 50 per cent of the exposed embryos by six hours after irradiation. The relative biological effectiveness (RBE) of fission neutrons relative to Co⁶⁰ γ -rays was thus 2.2 for this effect. The mortality data were not significantly different whether the embryos were examined at six hours or at ten to twelve hours after exposure.

To bring about 50 per cent mortality in similarly irradiated embryos six days after a single exposure, 894 ± 21 rads of γ -rays or 317 ± 2 rads of fission neutrons were necessary. Thus, at this second end point, fission neutrons were approximately 2.8 times as effective as the γ -rays.

When various fractions of the two radiations (1/3 γ , $2/3 n$; 1/2 γ , 1/2 n ; and 2/3 γ , 1/3 n) were employed consecutively on the embryos, the results indicated that, at least for the early mortality mode, the two radiations appear to be additive in their lethal effects.

The most obvious damage in the early period was to the circulatory system. Hemorrhages were most common in the brain, in the pericardial region, and within the allantoic vesicle. The extraembryonic area was usually drained of all blood when the embryo died.

The reliability and ease of this test for RBE are dis-

cussed. The results are compared with those of other investigators using other radiations and this same biological test.

It appears that fission neutrons are between two and three times as effective as Co⁶⁰ γ -rays in killing the four-day chick embryos, whether the six-hour or six-day point is utilized. This RBE figure is similar to that obtained from previous work on the newly hatched three-day-old chick.

Six figures; 7 tables.

Studies of Radio-Active Phosphorus Uptake in the Diagnosis of Intra-Ocular and Cutaneous Melanomas. Kelvin Lidgett, K. H. Clarke, and H. A. S. van den Brenk. *Australian & New Zealand J. Surg.* **29**: 149-164, November 1959. (Victorian Eye and Ear Hospital, Melbourne, Australia)

The rationale and application of radioactive phosphorus uptake determinations in the diagnosis of intraocular and cutaneous melanomas are discussed and the results obtained in 27 patients are reported.

An arbitrary value of 1.5 was set as an uptake ratio considered to be indicative of neoplastic change in the skin. All cutaneous melanomas giving uptake ratios above this figure were removed and pathological studies revealed the presence of malignant melanoma with penetration of the basement membrane and infiltration of underlying dermis by the malignant cellular process, in 5 cases.

In 2 patients the lesion was clinically designated as "melanosis," and gave negative uptake ratios. In one case a junctional nevus of low degree of activity registered a positive uptake. In at least 3 cases the malignant melanoma had arisen in a long standing patch of melanosis, and counts made over different portions of the pigmented lesion gave high but variable levels of radioactivity.

The intraocular lesions studied included 11 possible choroidal melanomas, 3 tumors of the iris, 1 intraocular metastasis, and 1 melanoma of the conjunctiva. Proved malignant lesions of the choroid anterior to the equator had positive uptake ratios, but posterior choroidal lesions gave less consistent results, attributed to the fact that the shape of the counter precluded measurements over the posterior surface of the globe. The test was unsuccessful in the small iris tumors.

A correlation was obtained between P³² uptake ratio, and the tumor nucleoprotein content based on measurements of volume and density of tumor cell nuclei.

It is concluded that the procedure described is of definite usefulness. "If the lesion is sufficiently accessible for surface counting the method is reliable, provided (1) the equipment used is sufficiently sensitive and correctly collimated, (2) tumor and both ipsilateral and contralateral control tissues are scanned adequately, (3) all measurements are repeated, to obtain consistent results, (4) sets of measurements are repeated over at least a twenty-four-hour period after administration of the isotope, and (5) a rigorous technic is adopted"

Thirteen figures; 6 tables.

Radiosodium Clearance Rates as Indicators of Femoral-Head Vascularity. Patrick G. Laing and Albert B. Ferguson, Jr. *J. Bone & Joint Surg.* **41-A**: 1409-1421, December 1959. (University of Pittsburgh, Pittsburgh 13, Penna.)

Avascular necrosis of the femoral head is an impor-

tant complication of trauma and disease of the hip, occurring in 17.8 to 23 per cent of cases of fracture of the femoral neck and in 15 to 30 per cent of cases of dislocation or fracture-dislocation of the hip. This paper is a report on animal experiments and preliminary clinical experience with radiosodium clearance studies in the determination of bone vascularity. The suitable isotope appeared to be Na^{24} rather than the longer-lived Na^{22} . The former has a half-life of 15.06 hours and most of its disintegrations give a beta particle of 1.39 million electron volts and two gamma photons with energies of 1.38 and 2.76 million electron volts. The gamma photons easily penetrate body tissues including bone, and surface-counting techniques may therefore be used.

To introduce the radiosodium into the bone and hold it there for ten minutes while counts were taken, while allowing no leakage, a special stainless steel syringe was developed. Na^{24} was used in a strength of 1,000 mc per milliliter for the first experiments, but this was later reduced to 50 to 60 mc per milliliter in both animals and man. The gamma photons emitted by the radiosodium were counted with a scintillation probe containing a thorium-activated sodium-iodide crystal. A crystal of 1/2 in. diameter was used in the first animal experiments. In clinical studies the increased sensitivity of a 2-in. crystal permitted a smaller isotope dose.

For the animal experiments, 22 large adult mongrel dogs were used, the right femoral head of each animal being devascularized. The left served as a vascularized control. Thirty femoral heads from the series were found suitable for study. In 15 (Group I), the clearance rate in ten minutes was 5 per cent or less, indicating complete devascularization. In 11 heads (Group II), the clearance rates were between 20 and 50 per cent, showing vascularization. In 4 heads (Group III), the rates were between 10 and 20 per cent, evidence of partial devascularization. The striking difference between the rapid clearance of the isotope from the vascular heads and its failure to move from all but 1 of the heads that had been devascularized is the essence of the experiment. Histologic examinations, in general, confirmed the results of the clearance studies.

Encouraged by their findings, the authors undertook a clinical trial of the method in 9 cases of fractured femoral neck, 5 of dislocation or fracture-dislocation of the hip, and 1 of spontaneous avascular necrosis of the femoral head. Patients with obvious roentgen signs of avascular necrosis of the femoral head, as well as patients with fresh trauma, were included. Obtaining controls for these studies on man was difficult. However, Na^{24} -clearance studies have been performed in 2 cases of roentgenographically obvious aseptic necrosis of the femoral head and in both cases clearances of 0 per cent were obtained.

The authors believe that radiosodium-clearance studies offer a simple and advantageous method of determining bone vascularity. If no clearance occurs, it is fairly certain that the femoral head is avascular.

The placing of the experimental chamber is open to debate. If a nail is to be inserted along the same track as the syringe, then the chamber should probably be in the postero-inferior portion of the head, although a test of Na^{24} clearance of the superior portion of the head may be of more prognostic value. In the case of dislocation of the hip and spontaneous avascular necrosis of the femoral head, there is no objection to performing

the clearance study in the superior portion of the head.

Full evaluation of the method must obviously await long-term follow-up studies.

Fourteen roentgenograms.

Absorption and Distribution of $S^{35}O_2$ Inhaled Through the Nose and Mouth by Dogs. Oscar J. Balchum, Jerzy Dybicki, and George R. Meneely. *Am. J. Physiol.* 197: 1317-1321, December 1959. (O.J.B., University of Southern California School of Medicine, Los Angeles 33, Calif.)

As one phase of an investigation of the effects of inhalation of sulfur dioxide, the authors attempted (1) to evaluate the role of the upper airways as a protective mechanism, and to determine whether they are effective in reducing the amount of SO_2 gaining access to the lungs and being absorbed by them, and (2) to determine quantitatively the distribution of S^{35} to various organs and tissues of the dog under these conditions of exposure.

Dogs breathing $S^{35}O_2$ through the nose and mouth were found to retain a smaller proportion of the inhaled gas in the trachea, lungs, hilar lymph nodes, and liver and spleen than those breathing similar concentrations via a tracheostomy. This conclusion was substantiated by tissue S^{35} concentration assays and measurements of the compliance of the lungs and thorax and of pulmonary resistance. The upper airways therefore partially protect the lungs from exposure to sulfur dioxide.

Four tables.

Autoradiographic Detection in Tissues of Tuberle Bacilli Labelled with Acetate-1- ^{14}C . A. Allegranza, G. Guidotti, R. Levi Setti, and F. Polvani. *Panminerva Med.* 1: 178-180, September 1959. (Istituto Neurobiologico "A. Verga," Via Ippocrate 45, Milan, Italy)

In the experiments reported here the technic of electron-track autoradiography was applied to the detection of labeled tubercle bacilli and their decay products in tissues. The method used for labeling the tubercle bacilli with C^{14} is described. Preliminary results show that the labeled organisms can be traced in various organs of the rat and guinea-pig. The authors conclude that electron-track autoradiography is particularly suitable for the study of the bacterial invasion of tissues and the ability of microorganisms or of their components to penetrate the endothelial barriers.

Four figures.

The Place of Radioisotopes in the Community Hospital. Frank R. Hendrickson. *J. Iowa M. Soc.* 49: 737-740, December 1959. (Presbyterian-St. Luke's Hospital, Chicago, Ill.)

The author believes that the use of radioactive isotopes as a clinical tool by an average community hospital is not only practical but necessary in bringing the best of medicine to the greatest number of patients. Many early problems have been solved and standard diagnostic procedures are safe for both patients and laboratory personnel.

In accordance with the basic approach to the problem, there are three groups of diagnostic methods with isotopes. The first is metabolic localization of the isotope as, for example, in thyroid studies with radioiodine and tumor localization with radioactive phosphorus, arsenic, copper, potassium, or tagged serum albumin. The second group is based on the dilution of the administered isotope throughout a specific space or

pool, as in blood-volume determination by means of tagged serum albumin or tagged red blood cells, total body-water studies with tritium H³, and sodium, potassium, and chloride space determinations with radioactive counterparts of these atoms. The third group of studies, based on the biologic use of the material administered, includes study of anemias with radioactive vitamin B₁₂, Cr⁵¹-tagged red blood cells, or iron; liver-function studies with radioactive rose bengal; study of pancreatic function with fats labeled with radioiodine; innumerable studies of basic metabolism with C¹⁴ in basic organic molecules.

The establishment of adequate clinical facilities is quite feasible economically. The basic investment in equipment for a small but efficient laboratory should range from \$4,000 to \$6,000. The performance of an average of 3 studies per day will support 1 full-time isotope technician and amortize all the equipment over a two-year period.

In addition to their use in diagnostic procedures, radioactive isotopes are playing a greater therapeutic role in such conditions as Graves' disease, intractable angina pectoris, and severe cardiac compensation, as well as in palliation of many cancers.

RADIATION EFFECTS

Minimizing the Genetic Hazard of Medical Radiation. George Cooper, Jr. *Virginia M. Monthly* 86: 685-691, December 1959. (University of Virginia, Charlottesville, Va.)

This paper opens with a brief history of x-rays and their hazards. The need is pointed out for exact statistics on the roentgen examinations which involve direct or indirect irradiation of the ovaries, performed during the reproductive years. As a contribution to that end, the procedures involving significant ovarian dosage at the University of Virginia in 1957 are tabulated by age and number.

It is considered that the diagnostic roentgenologist is minimizing radiation dosage by taking full advantage of modern equipment, using careful technic, including employment of shields whenever possible, and thoughtful planning of examinations. Concern about the genetic hazards can be focused on those studies which require the passing of the x-ray beam through or near the ovaries before the non-child-bearing age.

Ionizing energy used intelligently for medical purposes probably poses only a minor threat to genetic health.

Four roentgenograms; 1 diagram; 3 tables.

Gonadal Exposure Dose to Adults in Diagnostic Radiography. J. L. Wolfson and C. Garrett. *J. Canad. A. Radiologists* 10: 60-66, December 1959. (National Research Council, Ottawa, Ont., Canada)

The investigation reported here is concerned solely with the manner in which gonadal exposure varies with the factors normally subject to choice in practice: tube-field distance, field size, kvp (peak kilovoltage), and added filtration. Nineteen views were employed which encompass the great bulk of the work in diagnostic radiology. Investigation of radiography of the extremities was omitted in view of the relatively negligible gonadal dose exposure. All measurements applicable to both male and female were made on a single Mix D phantom of a male 5 feet 9 inches in height and 150 pounds in weight.

The study was carried out with a Westinghouse 100-kvp full-wave rectified unit. Inherent filtration of the tube was 0.5 mm. of aluminum. Two holes, each an inch in diameter, were directed to the position of the left ovary, one anteriorly and the other from the left side. Each hole was designed to receive a 10-c.c. ionization chamber for ovarian dose measurements.

In all measurements, care was taken to orient the chamber so that it occupied a position of maximum or near maximum sensitivity relative to the source of radiation, whether primary or scattered.

There are two major sources of error in the measurements (1) those due to variation in physical apparatus; (2) those associated with extrapolation of the data to human patients, leading to much larger uncertainties which are difficult and at times impossible to evaluate.

With regard to positioning the central ray, the authors suspect that differences in positioning may exist among radiologists. In fact, very large changes in gonadal exposure dose can result from small variation in the position of the central ray. Variation of ovary position from patient to patient can also produce large discrepancies between values measured in the phantom and actual values.

The results of the measurements made were tabulated but of the 46 tables only 3, concerned with the lumbar spine, are reproduced (the others are available from the authors). It was shown that increasing filtration in diagnostic units also leads to lower gonadal exposure dose at fixed mas, but that the ratio of gonadal dose to skin dose increases.

The authors occasionally found the gonadal dose to be higher than the skin dose. This is due to the fact that, even if the gonadal chamber and skin chamber received the same amount of radiation, the gonadal chamber would receive a larger contribution of scattered radiation.

Five figures; 5 tables. **PETER TORBEY, M.D.**
University of Missouri

Some Observations on the Treatment of Post-irradiation Hematopoietic Depression in Man by the Infusion of Stored Autogenous Bone Marrow. N. B. Kurnick, Bernard H. Feder, Andrew Montano, James C. Gerdes, and Robert Nakamura. *Ann. Int. Med.* 51: 1204-1219, December 1959. (VA Hospital, Long Beach 4, Calif.)

Repopulation of suppressed marrow with stored autologous marrow taken from the ilium has been utilized by the authors in an attempt to avoid the limitations of therapy imposed by radiation damage to the hematopoietic system. They studied and report here the results in reinfusing 4 patients receiving extensive radiation therapy for advanced cancer. An additional 10 patients similarly treated but not reinfused served as controls. Among the 4 reinfused patients return to pretreatment levels of all the formed elements of the blood was noted in one and a half to four weeks as contrasted with a minimum period of three months for recovery in the control group. In fact, in 8 of the controls the pretreatment level was never reached and all had been followed at least six months.

It is believed by the authors that marrow banking

prior to therapy and reinfusion when necessary will allow one to treat extensive neoplasms more vigorously with radiation and/or chemicals than would otherwise be possible. The number of nucleated cells necessary for successful "priming" is unknown, though it is being investigated by the authors; 400 million is the lowest number thus far successful. The original article should be consulted for details of marrow aspiration, storage, and reinfusion.

Fifteen figures. G. MELVIN STEVENS, M.D. Palo Alto, Calif.

Observations on Chimpanzees after Whole-Body Radiation and Homologous Bone Marrow Treatment. Harvey Rothberg, Eugene B. Blair, Alphonse C. Gomez, and Wilbur McNulty. *Blood* 14: 1302-1321, December 1959. (Walter Reed Army Medical Center, Washington, D. C.)

These authors made a careful study of 11 chimpanzees receiving two levels of total-body irradiation, 900 and 1,200 r. Six of the animals were subsequently given homologous bone-marrow transplants. In none was there any evidence of "take" of the homologous marrow. While it is suggested that it might be well to do experiments in lower animals, the higher one goes in the phylogenetic scale the greater would appear to be the difficulties in producing takes. These animals did not live long enough for the authors to determine if delayed sensitivity features were active. A summary of the acute radiation syndrome compared with man is given:

1. Mild gastrointestinal symptoms (nausea, vomiting, anorexia, and apathy) in the first few hours after irradiation.
2. Mild to moderate diarrhea in the first week after irradiation; however, some animals, especially in the 900 r group, appeared well during this period.
3. An asymptomatic period in the second week after irradiation, despite declining blood counts, which were unequivocally depressed as early as six days after irradiation.
4. A period of progressive illness in the third week after irradiation, in which platelet and leukocyte counts showed extreme depression, and animals had clinical hemorrhage and frequently fatal infection.

Six figures; 1 table. SYDNEY F. THOMAS, M.D. Palo Alto, Calif.

The Effects of Irradiation upon the Revascularization and Survival of Skin Autografts. Sheldon Oscar Burman. *Surg., Gynec. & Obst.* 109: 683-686, December 1959. (University of North Carolina, Chapel Hill, N. C.)

Surgeons are occasionally faced with the problem of skin grafting in sites which previously have been irradiated therapeutically. Failure of such grafts is not unusual. By employing injections of 4 per cent bromophenol blue into the marginal vein of the albino rabbit ear, the author compared, at various time intervals, the degree of revascularization of skin grafts placed on a previously irradiated ear with those placed on a normal ear.

The average time required for revascularization of an autogenous skin graft to the ear of a nonirradiated control rabbit is four and one-half days. When external irradiation, at 60 kvp and 20 ma, is given to produce a severe erythema, and then at varying intervals skin

grafts are applied to the irradiated ear, profound changes in the revascularization time and percentage of survivals occur.

During the initial irradiation erythema stage, effective revascularization occurs sooner than normal and all the grafts survive, suggesting a measure of security for grafts done at this early time. As the interval following irradiation lengthens, to the posterythema stage, a progressively longer time is needed for revascularization until nearly all the grafts fail. However, as the late appearance of telangiectasis heralds the end of the irradiation inflammatory response, angioblastic activity is resumed in the recipient site and revascularization time and graft survivals return to normal.

Thus, in the rabbit's ear, there appears to be an early and late optimum time for skin grafting after external irradiation. The grafts, however, tend to fail during the intermediate period.

One graph. ROBERT E. CAMPBELL, M.D. University of Pennsylvania

Early Changes in the Lens Epithelium After Roentgen Irradiation. A Correlated Light and Electron Microscopic Study. Theodor Wanko, Ludwig von Sallmann, and Mary Ann Gavin. *Arch. Ophth.* 62: 977-984, December 1959. (Ophthalmology Branch, National Institute of Neurological Diseases and Blindness, Bethesda 14, Md.)

The eyes of young albino rabbits were exposed to x-rays for a dose of 1,500 r. The lens epithelium, in the form of Feulgen-stained flat mounts, was examined one, four, ten, and fourteen days after irradiation with the light microscope. Examinations were also made with the electron microscope.

Cells affected by ionizing radiation were found to be randomly distributed throughout the epithelium but were more numerous in the equatorial zone. The changes occurred in all cell constituents except the Golgi complex and ranged from slight alterations of the individual components to partial disintegration of the whole cell. The lesions gradually increased, with time after irradiation, in extent and in the number of structural elements involved. Changes in the organization of nuclei, nucleoli, mitochondria, endoplasmic reticulum, cell membranes, and the fine, low-density components are described in detail and correlated with the data obtained from the Feulgen reaction.

Twenty-three figures; 2 tables.

Gastrointestinal Function During Exposure to X-Rays. D. C. Jones and D. J. Kimeldorf. *Radiation Res.* 11: 832-843, December 1959. (U. S. Naval Radiological Defense Laboratory, San Francisco, Calif.)

In view of the rapidity with which radiation-induced gastrointestinal dysfunction becomes apparent, a quantitative investigation of gastrointestinal function during the period of irradiation was made. The transit of injected material through the stomach and small intestine during exposure was used as a quantitative index of gastrointestinal function. Gastric motility was studied by means of a balloon-kymograph technic because of the predominant role of motility in gastric transit. Various ancillary treatments and drugs were employed in an attempt to modify the gastric response during radiation exposure in order to clarify the mechanism of the response.

The data obtained are consistent with the hypothesis that gastric transit over short periods of time is an ex-

ponential decay type of process. The effect of exposure to radiation is to decrease the rate of transit in intact animals by a factor of at least 3, with no latent period or minimum effective dose involved. Gastric motility is depressed and may play a role in decreasing the transit rate during radiation exposure. In adrenalectomized animals, gastric transit is a much more rapid process than in normal animals, and shows little or no decrease during exposure to radiation. It is suggested that adrenal action is important for the radiation-induced delay in gastric transit as measured by this technique.

Passage of test material through the small intestine also appears to follow an exponential type of process, moving most rapidly at the pyloric end, and least rapidly as the cecum is approached. In contrast to gastric transit, however, intestinal transit during exposure to ionizing radiation seems to proceed at a rate indistinguishable from that observed in nonirradiated control animals.

Five figures.

X-Irradiation of the Exteriorized or in Situ Intestine of the Rat. M. F. Sullivan, S. Marks, P. L. Hackett, and R. C. Thompson. *Radiation Res.* 11: 653-666, November 1959. (Hanford Laboratories, Richland, Wash.)

A comparison was made of the effects in rats of 250-kv x-irradiation of the surgically exteriorized intestine and of the intestine *in situ*.

Rats receiving abdominal irradiation were placed on their sides in a 1/4-in. lead shield. The region irradiated (3 × 5 cm.) extended from the greater trochanter about 3 cm. anteriorly to the posterior margin of the rib cage. The vertebral column, spleen, kidneys, almost all of the liver and the proximal and distal portions of the intestine were shielded from direct irradiation. In the surgical group, the intestines were manipulated through a midline incision and exposed to radiation on a cardboard plaque. The remainder of the body was shielded by 1/4 in. lead. After irradiation, the intestines were replaced and the abdomen closed. At intervals the rats were bled *via* the tail vein for hematologic analysis.

Mortality studies indicated that the LD 50 was 1,550 r and the mean survival time 7.1 days after irradiation of the exteriorized intestine. For the rats whose intestines were irradiated *in situ*, the LD 50 was 1,620 r and the mean survival time 5.7 days.

A transient lymphopenia occurred after 900, 1,500, and 1,900 r, being maximal five days after exposure. It was more marked and persisted for a longer time after *in situ* irradiation of the intestines. The granulocyte count was also decreased in this group, reaching a minimum at the same time. When the intestines were exteriorized during the radiation exposure, however, there was no decrease in the granulocyte count.

Pathologic damage ranged from transitory mitotic inhibition after 900 r to severe mucosal ulceration after 1,500 and 1,900 r. Residual damage was evident as long as forty-three days after irradiation.

Nine figures.

Initial Depletion and Subsequent Recovery of Spermatogonia of the Mouse after 20 r of Gamma Rays and 100, 300, and 600 r of X-Rays. E. F. Oakberg. *Radiation Res.* 11: 700-719, November 1959. (Oak Ridge National Laboratory, Oak Ridge, Tenn.)

On the basis of experiments with 20 r of γ -rays and

600 r of x-rays, the author, in 1955 (*Radiation Res.* 2: 369, 1955), concluded that killing of cells rather than inhibition of mitosis was the primary factor responsible for radiation-induced depletion of spermatogonia. Claims to the contrary, however, have persisted. More recent experiments have been carried out with both 100 and 300 r, and the results, in the author's opinion, confirm the earlier conclusion. One of the reasons why this response of spermatogonia has been missed is that observations are not timed to detect the peak incidence of degeneration at twelve to fifteen hours after irradiation. Furthermore, a return to the low normal incidence of necrotic cells occurs by twenty-four hours after 20 r, three days after 100 r, seven days after 300 r, and ten days after 600 r.

Most of the claims of a prolonged mitotic inhibition of spermatogonia have been based on rarity of division figures in the testis as a whole rather than on an exact rate based on surviving cells. Errors in cell classification and in concepts of normal spermatogenesis also have contributed to the confusion in interpretation of radiation response of spermatogonia. The author's data support the conclusion that radiation-induced mitotic inhibition in spermatogonia is similar to that observed in other mitotically dividing cells and is not a major factor in depletion of the seminiferous epithelium.

Division of surviving spermatogonia begins before degeneration of damaged cells has been completed. Accordingly, it is difficult to obtain exact estimates of the minimum number of surviving cells. As the radiation dose is increased from 20 to 600 r, the time of occurrence of the minimum number of type A spermatogonia is increased from twenty-four hours to seven days as a result of the concurrent interaction of degenerative and repair processes.

Four figures; 7 tables.

Residual Injury Induced in the Erythropoietic System of the Rat by Periodic Exposures to X-Radiation. S. J. Baum and E. L. Alpen. *Radiation Res.* 11: 844-860, December 1959. (U. S. Naval Radiological Defense Laboratory, San Francisco, Calif.)

Earlier investigations indicated that in surviving animals the anemia induced by ionizing radiation nearly disappears within thirty days. The authors found no study, however, which correlated these peripheral values with a return of the hematopoietic system to pre-irradiation activity. Experiments were undertaken to determine whether nonrecoverable damage in proliferating erythrocytes could be detected by studying the appearance of Fe⁵⁹ in the peripheral circulation.

Rats of the Sprague-Dawley strain repeatedly treated with x-rays in doses of 300 or 400 r at three-month intervals showed diminution in Fe⁵⁹ incorporation into erythrocytes after each exposure.

The results for the total rat population indicated a heterogeneity in response of erythroid precursors to the effect of irradiation. When these populations were regrouped into subgroups based on whether they survived three, four, or five radiation exposures, it was observed that the Fe⁵⁹ incorporation, on the average, decreased exponentially with increasing number of exposures.

Much higher single x-ray exposures were necessary to produce the depressions in Fe⁵⁹ uptake observed in rats irradiated repeatedly with 300 r and 400 r.

In contrast to the bone-marrow changes, peripheral erythroid decreases were small until the last irradiation period in the two female groups as measured by the

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hematocrits. This indicates that the quantity of stem cells available for erythrocyte production must greatly exceed the number required in the daily red cell turnover. It must be questioned whether rats with an impaired erythrocyte proliferation system could respond to emergency situations as well as normal animals.

Irradiation apparently accelerated the appearance of mammary tumors in the females. These tumors develop spontaneously in the stock employed in the investigation, but the appearance in the nonirradiated animals was at a much more advanced age.

Six figures; 5 tables.

Effect of Whole-Body X-Irradiation on the Adrenal Medulla and the Hormones Adrenaline and Noradrenaline. McC. Goodall and Merritt Long. *Am. J. Physiol.* **197:** 1265-1270, December 1959. (Memorial Research Center and Hospital, Knoxville, Tenn.)

The purpose of the experiments described here was to determine the effect of x-irradiation on the adrenaline and noradrenaline content of the adrenal gland and on the biosynthesis of these hormones. Rats, rabbits, and cats were employed in the investigation. Adrenal glands were removed at various intervals following irradiation and assayed for adrenaline and noradrenaline. Further, irradiated adrenal slices were incubated with labeled tyrosine and labeled methionine and the effect of irradiation upon the biosynthesis of adrenaline and noradrenaline was determined. The results of these experiments show that x-irradiation (1,770 r) does not decrease the biosynthesis of adrenaline and noradrenaline. Whole-body irradiation does, however, cause the adrenaline and noradrenaline content of the adrenal gland to decline, with eventual return to normal. In view of these findings, it would seem that irradiation represents another form of "stress" in which the physiological demand for adrenaline and noradrenaline is so great that the adrenal gland is partially or completely depleted of its adrenaline-noradrenaline storage.

Four figures; 2 tables.

Delayed Mortality of Radiation Chimeras: A Pathological and Hematological Study. M. J. de Vries and O. Vos. *J. Nat. Cancer Inst.* **23:** 1430-1439, December 1959. (Rijswijk Z. H., Netherlands)

The hematologic and pathologic changes in lethally x-irradiated mice treated with isologous, homologous, or heterologous (rat) bone marrow are reported. The irradiated bone-marrow recipients were CBA males ten to twelve weeks of age, weighing 20 to 25 gm. Female CBA and C57BL mice six to eight weeks old were used as donors of the isologous and homologous bone marrow, respectively. Young females of an inbred Wistar albino strain (WAG) six to eight weeks of age and weighing 100 to 120 gm., were employed as donors of rat bone marrow. The mice were irradiated with 65 r (LD 100/30).

During the one hundred and thirty days of the experiment no mortality occurred among the unirradiated, untreated controls or the mice treated with isologous bone marrow. All irradiated, untreated control mice were dead on the eleventh day after irradiation. Of the animals treated with homologous bone marrow, 83 per cent died spontaneously between the eighth and one hundred and twenty-eighth days. Ten per cent of the deaths took place before the thirtieth day, maximum mortality occurring after the first month. Eighty-seven per cent of the animals treated with heterologous

bone marrow succumbed between the eleventh and the ninety-second days. In this group maximum mortality occurred in the first month, 46 per cent of the mice dying before the thirtieth day.

Two different disease entities were observed in mice treated with homologous or heterologous marrow. Bone-marrow aplasia resulting in death from septicemia or hemorrhage occurred chiefly before the thirtieth day after irradiation. The secondary bone-marrow failure is explained by an immunological reaction of the host against the bone-marrow graft. After the thirtieth post-irradiation day, the animals were emaciated and had dermatitis, pneumonia, diarrhea caused by focal colitis with crypt degeneration, and necrosis of the liver. The delayed foreign bone-marrow reaction is of a complex nature. Impaired recovery of radiation-induced lesions, decreased resistance to bacterial infections, probably due to generalized atrophy of the lymphatic tissues, as well as an immunological reaction of the graft against the host are postulated to be causal factors. Bone-marrow aplasia predominated in the mice treated with heterologous bone marrow. In contrast, the mice to which homologous bone marrow was administered were chiefly affected by pneumonia, diarrhea, and colitis. Regeneration of the lymphatic tissues occurred within a month after irradiation in mice treated with isologous bone marrow, but it was retarded or failed to take place in animals treated with foreign bone marrow. The possible relation of the lymphatic tissue changes to the etiology of the "secondary disease" is discussed.

Nine photomicrographs; 7 graphs; 5 tables.

Some Effects of Roentgen Rays (220 kvp) and Gamma Rays (Cobalt-60) on Chicken Eggs. M. K. Loken, A. A. Beisang, D. G. Mosser, and J. F. Marvin. *Atom-praxis* **5:** 469-472, 1959. (University of Minnesota Hospitals, Minneapolis 14, Minn.)

An investigation was made of the relative biological effectiveness (RBE) on fertile chicken eggs of roentgen rays from a 220 kvp therapy machine and gamma rays from a cobalt-60 teletherapy unit.

The following observations were made:

(1) The third and eighteenth days of development of the chick embryo appear to be the times when death is most likely to occur. This is true for both irradiated and unirradiated embryos.

(2) Hemorrhage does not appear to be a significant cause of death of irradiated embryos.

(3) Absorption of embryos that died during the first day of incubation is completed on or before the fifth day of incubation.

(4) Embryos surviving radiation treatment appear to develop at a normal rate.

(5) After the fifth day of low-temperature storage, the viability of embryos decreases. The irradiation of the embryos prior to low-temperature storage does not change the appearance of the viability curve.

(6) Irradiation of chicken embryos in the early gastrula stage does not increase the number or type of gross abnormalities.

(7) Chickens that hatch from irradiated and unirradiated eggs do not exhibit apparent differences in growth rate. Both are able to carry out the normal life functions including reproduction.

(8) No differences are apparent in the offspring (second and third generations) of the chickens hatched from irradiated and unirradiated eggs.

Four graphs; 2 tables.

Effect of Bone Marrow Culture *in Vitro* on Its Protective Action in Irradiated Mice. Daniel Billen. *J. Nat. Cancer Inst.* 23: 1389-1395, December 1959. (M. D. Anderson Hospital, Houston, Texas)

Mouse bone-marrow cells cultured in a special container were studied in an attempt to identify those responsible for the protection afforded lethally irradiated mice. After four days of culture, a decreased protective activity of injected tissue-cultured cells was observed. By the ninth day of life *in vitro*, the explanted cells had essentially lost their protective capacity. Analysis at this time showed the presence of cells morphologically resembling stem-cell types (lymphocyte-like and myeloblasts) in cultures no longer exhibiting protective activity in irradiated animals. This was surprising in light of the massive evidence suggesting a repopulation of the irradiation-depleted hemic system by donor cells.

The lack of protection by populations of tissue-cultured cells containing differentiated cells still capable of division may be explained by (1) an insufficient quantity of seeding cells, (2) alterations in the specific functions or potentials of these cells, which result in a loss of ability to serve as precursors of the several terminal blood elements, (3) failure of such cells to multiply on introduction into the irradiated host, and (4) the absence of a specific cell type found only in fresh bone marrow or cultures of short duration *in vitro* and not sufficiently different morphologically from other primitive blood cells to be identified.

Two additional comments on the bone-marrow cell species involved in protection are pertinent. Few erythropoietic elements remained in protective four-day cultures. This does not necessarily rule out the erythroid elements as necessary for recovery of recipient irradiated animals, since the primitive cells may still be capable of providing such elements on transplantation into the host. In future studies it is hoped to determine by immunological methods the derivation of erythrocytes in host mice protected with four-day cultures. The absence of megakaryoblasts or megakaryocytes in cultures maintained for a week or longer raises the question of the importance of these platelet precursors in bone-marrow protection.

Six photomicrographs; 2 tables.

Effect of Post-Irradiation Bone Marrow Treatment on Rat Spleen Nucleic Acids. R. M. Iammarino and M. Benenbom. *Radiation Res.* 11: 820-824, December 1959. (R.M.I., Cleveland Metropolitan General Hospital, Cleveland 9, Ohio)

A study was made of the ability of rat bone marrow, given to rats one to two hours after 400 r of whole-body x-irradiation, to prevent or correct previously observed changes in the weight, RNA (ribonucleic acid) content, DNA (deoxyribonucleic acid) content, and DNA purine-pyrimidine composition of the spleen. Two days after

irradiation there was no evidence of prevention of these changes, but at seven days there was a slight beneficial effect on recovery as shown by significantly larger values for spleen weight, RNA content, and DNA content in irradiated rats receiving bone marrow than in those not receiving this treatment. Bone marrow given to irradiated rats did not prevent or correct the changes in the purine-pyrimidine composition of spleen DNA which follow 400 r of whole-body x-irradiation.

Two tables.

Factors Influencing the Radioprotective Action of Cysteine: Effects in *Escherichia coli* Due to Drug Concentration, Temperature, Time, and pH. Henry I. Kohn and Shirley E. Gunter. *Radiation Res.* 11: 738-744, November 1959. (Radiological Laboratory, University of California School of Medicine, San Francisco, Calif.)

Protection by L-cysteine against the lethal action of 250-kv x-rays was studied in washed, buffered, dilute suspensions (4×10^4 cells/ml) of *Escherichia coli*, strains B and B/r, initially in equilibrium with air. It was found that cysteine protection was the end-result of events in two sequential periods: a temperature-dependent *reaction period*, during which a state of protection developed, followed by a temperature-independent *irradiation period*, during which some of the toxic effects of the absorbed x-rays were prevented or corrected.

The degree of protection that developed during the reaction period depended on the interrelated effects of temperature (0.1° to 37° C.), pH (5.1 or 7.8), drug concentration (0.0001 to 1.0 M), and time (3.5 to 60 minutes). It was of special interest that pH changed the shape of the curve relating protection to drug concentration from linear (pH 5.1) to S-shaped (pH 7.8). The two curves crossed in the region of half-maximum protection (3×10^{-3} to 10^{-2} M), so that at low concentrations more protection was obtained at pH 5.1 but at high concentrations the reverse was true.

The great variety of results that could be obtained by varying the experimental conditions indicates the importance of physiological and biochemical factors in determining protection. In addition, they illustrate how different results in different laboratories can be largely a matter of experimental design.

With respect to the anoxia theory of cysteine action, results showed that anoxia was the major factor under certain conditions. Under other conditions, however, the autoxidation of cysteine in the medium could not induce anoxia; yet significant protection occurred. It was concluded that some kind of non-anoxic mechanism was at work. This conclusion was supported by finding that the maximum value of the protection ratio ranged from 4 to 6, above the value of 3 predicted by the anoxia theory.

Five figures; 2 tables.

AUTHORS' SUMMARY

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